Final Report to the President on the U.S. SPACE PROGRAM

January 1993

THE VICE PRESIDENT
WASHINGTON

January 7, 1993

The President
The White House
Washington, D.C. 20500

Dear Mr. President:

I am pleased to transmit to you this final report on the U.S. space program. It has been my great privilege to serve as Chairman of the National Space Council over these past four years. At the beginning of the Administration, you made it clear to me that you were determined to keep America first in space. We have accomplished that, and much more.

As you know, there were many challenges. At the outset of the Administration, the nation's space program was still recovering from the Challenger accident. Our commercial space enterprises were coming under increasing pressure from a variety of players in the domestic and international marketplace. The need for more reliable data on environmental change was placing new demands on the space program.

More recently, the collapse of the Soviet Union, unprecedented global political and economic upheaval, lessons learned from Operation Desert Storm, and increasing and often conflicting claims on spending priorities have forced further reassessments of many of our space policies. Last summer, I commissioned the Vice President's Space Policy Advisory Board to provide broad policy recommendations as the nation continues to adjust to these changes. The Board's recently released findings and recommendations are highlighted in this report.

In spite of all these challenges -- indeed, because of them -- this Administration will leave behind an important legacy of accomplishment. I believe the policy foundations that we have laid in response to these challenges will serve America well and will stand the test of time.

This report highlights the accomplishments of the Administration, identifies the policies and programs it has put in place, and points the way to the future. Like those who came before us, we must rely on our successors to build upon what has been achieved. The success of our space program over three and a half decades would not have been possible without a bipartisan coalition of engineers, scientists, government and industry leaders, and most importantly, generations of Americans with a shared vision and a strong belief in U.S. leadership. With that in mind, I conclude this report with a series of recommendations for the future which I hope will be received as they are intended -- to aid the next administration, Republicans and Democrats in Congress, and the American people as they shape our space program over the coming years.

Sincerely,

The National Space Council

The National Space Council is responsible for advising the President on national space policy and strategy, and coordinating the implementation of the President's policies. It was authorized by an act of Congress in 1988 and was established as an agency of the federal government by President Bush on April 20, 1989.

The Space Council is chaired by Vice President Dan Quayle, who serves as the President's principal advisor on national space policy and strategy.

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Chairman

The Secretary of State
Lawrence Eagleburger

The Secretary of the Treasury
Nicholas F. Brady

The Secretary of Defense
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The Chief of Staff to the President
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The Director of Central Intelligence
Robert Gates

The Administrator of the National Aeronautics and Space Administration
Daniel Goldin

National Space Council Executive Secretary
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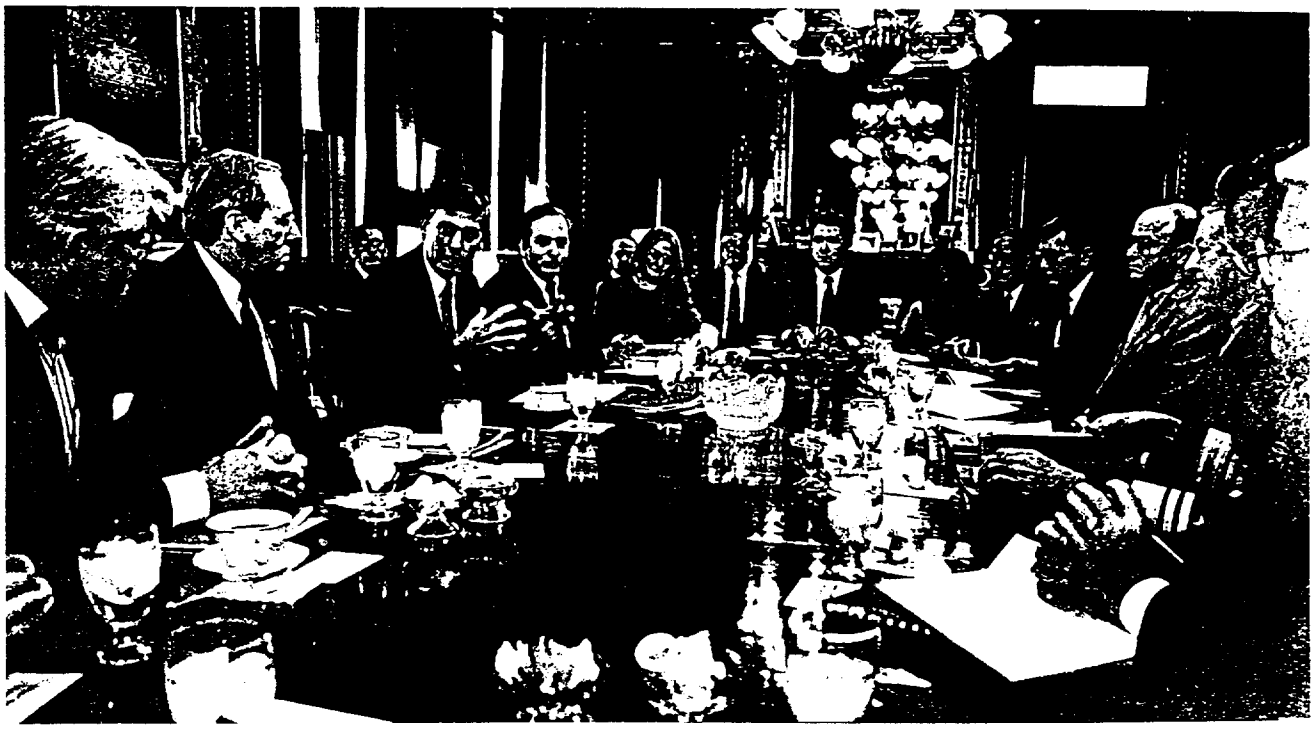

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Space Leadership

Space is vitally important to our nation's future and . . . to the quality of life here on Earth . . . It offers a technological frontier, creating jobs for tomorrow. And space programs inspire an interest in math, science, and engineering in young people — knowledge so important for a competitive future. Space offers us the chance to unlock secrets billions of years old and billions of light-years away. Space is the manifest destination of a new generation and a new century.

— President George Bush

At the outset of this Administration, as the U.S. space program entered its fourth decade, a series of challenges faced space policymakers. Many of those challenges were the result of past policy decisions. We were just beginning to emerge from the shadow of the Challenger accident that had paralyzed our space program for over two years. The return to reliance on our aging expendable launch systems and our continuing dependence on the Space Shuttle had revealed the shortcomings of our overall space transportation capability in terms of both cost and performance. These shortcomings, among others, were placing U.S. companies at a competitive disadvantage in world markets for space goods and services, where a variety of foreign players were increasingly reaping the rewards of more deliberate and effective government support.

Other challenges were the result of relatively new developments, including the demand for information to understand potential threats to the global environment. Speculation about the extent to which natural phenomena as

well as human-induced activities were contributing to adverse global environmental changes placed new requirements on the U.S. space program for reliable space-based data collection and systems to analyze that data.

But perhaps most significant were the more recent sweeping global political and economic changes. The collapse of the Soviet Union and the concomitant decline in U.S. defense spending, a global economic recession, and new and often conflicting demands on U.S. spending priorities all affected the U.S. space program and required — and continue to require — fundamental changes in U.S. space policy.

During these past four years, and particularly during this period of upheaval, this Administration has remained steadfast in its commitment to maintain U.S. leadership in space. Space contributes to our quality of life, to our national competitiveness, to the acquisition of knowledge, to our national prestige, and to our economy.

Space is also assuming an increasingly important role in our national security. Operation Desert Storm demonstrated that even with the Soviet threat diminished, threats to global security will continue to exist, and space will be crucial to our ability to provide for our national defense and maintain global stability.

The National Space Council, established by President Bush at the outset of the Administration, has provided direction and continuity during this period of great change. It was charged with developing recommendations for the President on space policy, developing a strategy for national space activities, and monitoring and coordinating the implementation of U.S. national space policy. It brought together the leaders of the departments, agencies, and White House offices with space program oversight and laid a comprehensive policy foundation for the U.S. space program.

Early on, the Council's efforts were focused on five strategic objectives:

- To develop U.S. space launch capability and related infrastructure as a national resource,

- To open the frontiers of space through both human and robotic exploration,
- To intensify our use of space in solving problems here on Earth,
- To use space to foster our economic well-being, and
- To ensure the freedom of space for exploration, development, and security.

Much was accomplished. America was challenged to build on its pioneering achievements in space exploration by moving forward with Space Station Freedom, returning to the Moon, and mounting a human expedition to Mars. Aggressive research and technology efforts were supported and enhanced through programs like the National Aerospace Plane (NASP). A commercial launch policy was developed to address the trading environment in which U.S. firms compete with a variety of foreign entities, and guidelines were issued to support and encourage commercial space activities at home. A national space launch strategy was established, calling for a transition away from our current expensive, inefficient systems through the development of a new, less costly, and more responsive family of launch vehicles. New international cooperative projects were undertaken with our traditional partners as well as with Russia. The civil remote sensing program was renewed and strengthened. These, and other accomplishments, are documented in this report.

On the assumption, however, that the post-Cold War era will require additional near-term and long-term adjustments to our space program, the Vice President's Space Policy Advisory Board was tasked last summer to undertake a series of forward-looking assessments. This nonpartisan group of experts was asked to consider what changes might be necessary for more effective implementation of our space launch strategy, to preserve our critical U.S. space industrial base, and to achieve an overall space policy structure that more accurately reflects current national and international conditions.

In three reports released recently, the Board recommended the continuation of several important Administration initiatives: to develop a new, cost-effective space launch system, to streamline acquisition and regulatory mechanisms, to foster and support U.S. private sector commercial ventures, to improve the space support infrastructure, and to aggressively pursue science and technology. The Board also recommended significant changes in the way the U.S. space program is managed and organized, as well as other important changes highlighted in this report.

When viewed as a whole, the seven National Space Policy Directives (NSPDs) signed by President Bush over the last four years, several other decision memoranda and policy statements, six major nonpartisan assessments including the three recent studies, a series of international agreements, as well as an aggressive commitment of resources, define the history of this Administration's stewardship of the space program, the policy foundation it has laid, and the challenges that lie ahead for the next administration. Many of these milestones are noted in an appendix to this report.

The following section highlights the policy initiatives and activities undertaken by the Administration in the areas of space transportation, national security, civil space, and space commerce and trade. The concluding section contains a series of policy recommendations that build on the accomplishments of this and preceding administrations and recently completed Advisory Board policy assessments. They are intended to assist the next administration in the important deliberations it will undertake on the future of this critical national asset.

Status of the U.S. Space Program

Space Transportation

America's space launch capability is the fundamental building block for all of its space activities. Yet the United States finds itself at a critical juncture. Our systems were developed decades ago, they are expensive to build and operate, and they lack operability and responsiveness. The policy decisions of the late 1970s, which committed the nation to exclusive reliance on the Space Shuttle, led to the termination of all investments in expendable launch vehicle (ELV) infrastructure. Following the Challenger accident, the nation was forced to spend more than $12 billion to restore ELV operations and transfer satellites designed for the Space Shuttle back to these aging launchers. Thus, our early decision to rely totally on the Space Shuttle delayed needed improvements in space launch by some two decades.

The Space Shuttle has now been returned to full flight status, and during the past year it flew eight times, more than in any year since before the Challenger accident. Of the total time Space Shuttles have spent in orbit, 20 percent occurred during the past year. In addition, a record seven out of eight flights were launched on schedule. This has been accomplished while simultaneously reducing operational costs and maintaining crew safety.

The loss of American dominance in the international launch market to foreign competitors demonstrates the importance of continued investments in space transportation technology and infrastructure. This is among the lessons to be learned from the stable funding and commitment to improved

performance we see overseas. The most conspicuous example is Europe's Ariane V program, which promises to result in a low-cost, reliable, and improved launch system for worldwide users.

Several exercises conducted under National Space Council auspices over the past three years have attempted to focus informed attention on the need to strengthen America's space launch capability. First, *The Report of the Advisory Committee on the Future of the U.S. Space Program*, chaired by Mr. Norman Augustine, Chief Executive Officer of Martin Marietta, recommended the development of a new national launch system. The so-called Augustine Committee found that the most significant deficiency in the nation's future civil space program is the lack of a reliable, flexible, and efficient space launch capability. The Committee recommended strongly that the nation move ahead quickly to develop a more robust launch capability.

The need for a new launch capability has been reinforced by every government study and outside advisory panel that has addressed this issue since the Augustine Committee report and, indeed, since the Challenger accident. Key members of the National Space Council, including the NASA Administrator and the Secretary of Defense, agree strongly with this recommendation.

In July 1991, the President issued the National Space Launch Strategy, NSPD 4, that established a long-range plan to meet America's space launch needs well into the next century. Agencies were directed to:

- Ensure that existing space launch capabilities, including support facilities, are sufficient to meet U.S. government manned and unmanned launch needs;

- Develop a new, man-rateable, space launch system to reduce costs and improve performance;

- Sustain a vigorous space launch technology program to apply to both existing and new space launch systems; and

- Actively consider commercial space launch needs and factor those needs into the decisions on improvements in space launch facilities and vehicles.

The environment in which these directives were to be implemented, however, has changed significantly with increasing international competition and difficult fiscal realities at home. Recognizing the urgency to refine our space transportation objectives and devise an effective implementation plan, a Task Group of the Vice President's Space Policy Advisory Board, led by former Secretary of the Air Force E.C. (Pete) Aldridge, Jr., recently conducted a study on *The Future of the U.S. Space Launch Capability.* The report, released in November 1992, endorsed the 1991 National Space Launch Strategy, but found that implementation by the key government agencies, Congress, and industry had not been adequate. Specifically, it found that while the United States is meeting the minimum basic needs of launching payloads into space to support government and commercial missions, it is not taking advantage of new efficient, reliable, and low-cost technological and manufacturing concepts. As a consequence, we are lagging farther behind virtually every other national or multinational launch program.

The principal recommendation of the Task Group was that the government should develop a new launch vehicle, dubbed "Spacelifter." Recognizing that at least 85 percent of U.S. launch requirements are in the range of 20,000 pounds — or less — to low Earth orbit, the Spacelifter program would focus initially on a medium-lift capability to satisfy most national payload requirements, but would have growth potential to fulfill heavier lift requirements up to 50,000 pounds.

The Task Group suggested that the development of a personnel launch system and a cargo transfer and return vehicle compatible with the Spacelifter could allow a phaseout of the Space Shuttle system by about 2005, with prudent time for overlap. The group also endorsed the Administration's commitment to NASP, and to other advanced technology programs such as space nuclear power and propulsion. NASP development, in particular, lays the foundation for revolutionary improvements in space launch and hypersonic flight, and can contribute to continued U.S. leadership in aerospace into the 21st century.

Finally, the Task Group recommended centralizing space launch management, continuing infrastructure improvements, and supporting advanced technology development.

As Dr. Sally Ride stated in her 1987 report, *Leadership and America's Future in Space,* "From now until the mid-1990s, Earth-to-orbit transportation is NASA's most pressing problem." During the intervening five years, efforts to secure support for a new launch system have been largely unsuccessful. The failure of our institutions — U.S. Government agencies, Congress, and the aerospace companies — to converge and agree to support and fund a new launch system not only is shortsighted, but will prevent us from achieving many — if not most — of our long-term space objectives. Though blame can be assigned to all parties, little will be gained from finger pointing. We must move ahead. If the United States is to control its own destiny in space, a nonpartisan effort must be directed immediately to implement a new launch program.

National Security

The importance of a strong military space program to U.S. national security was clearly demonstrated during the Persian Gulf crisis. The superiority of U.S. space communications, navigation, weather reporting, reconnaissance, surveillance, remote sensing, and early warning systems was critical to the success of the coalition forces in Operation Desert Storm. Secretary of Defense Dick Cheney later noted that our space systems were a prime example "of the way technology went to work making our troops more effective and . . . safer." Control of space was essential to our ability to prosecute the war quickly, successfully, and with minimum loss of American personnel.

Space assets enhance the ability of U.S. forces to reach their objectives and act as "force multipliers" for our air, sea, and land forces. The advanced command, control, and communications network provided by these assets reduces the size of the force necessary to accomplish a mission. Support for

ground and air operations during the Gulf War came from a combination of military and civil space systems.

Accurate, realtime weather information provided by the Defense Meteorological Satellite Program, combined with satellites of the National Oceanographic and Atmospheric Administration (NOAA), was critical to the success of our air operations and saved American and coalition forces lives.

The space-based Global Positioning System (GPS) — a constellation of satellites that can transmit extremely accurate position information to hand-held receivers — was used for the first time in combat and was invaluable in guiding coalition forces movements across trackless desert sands. In contrast, some Iraqi units were unable to navigate in their own terrain, lacking access to space-based positioning systems.

The Defense Support Program, our early warning satellite system, allowed rapid identification of Iraqi Scud missile launches and quick alerts to our troops, enabling Patriot missile batteries to target and destroy the incoming missiles. The Landsat satellite broad-area, multispectral images of the Persian Gulf region were extremely valuable in the preparation of tactical maps for combat operations. Surveillance systems helped identify enemy targets and validated the success of allied strikes.

The Chairman of the Joint Chiefs of Staff, General Colin Powell, noted that the ability of the United States to use military force effectively relied heavily on support from the "high ground" of space. The important role of space systems to the success of Desert Storm did not go unnoticed by our allies, or by our potential future adversaries. Accordingly, many nations are moving to acquire space systems to improve their military capabilities.

For the past twenty years, the United States has been ambivalent and indecisive about the desirability of maintaining a comprehensive space control capability. Until the early 1970s, the United States operated an antisatellite (ASAT) missile system capable of destroying space-based assets of our adversaries. Its principal purpose was to deny the use of space to the former Soviet Union in time of war. That program was terminated and a successor

program, the Air Force Miniature Homing Vehicle, was never deployed operationally.

Supporters of an ASAT system have argued that the capability to deny the use of space to an adversary can add great protection to U.S. land, sea, and air forces during hostile military action. Its opponents, however, have argued that U.S. interests are best protected by seeking to avoid an "ASAT race" with the former Soviet Union, thereby preserving a "space sanctuary." But the proliferation of space systems has changed profoundly the space control equation, and the "space sanctuary" concept has been overtaken by events. Sixteen nations today have some degree of indigenous capability to employ militarily useful satellites. That number is expected to double by the beginning of the next century. Had the Iraqis possessed militarily useful space systems during Operation Desert Storm, coalition maneuvers could have been detected and many American lives might have been lost.

To counter such threats, the nation more than ever needs a comprehensive space control capability, including space surveillance systems that can detect and track hostile objects in space, satellites that are impervious to interference from hostile forces, and a comprehensive antisatellite capability to deny the military use of space to future enemies. The United States would never tolerate the flight of enemy airborne reconnaissance vehicles over U.S. military forces. Similarly, the United States should not allow hostile space-based reconnaissance systems to overfly and threaten U.S. forces with impunity.

In addition, we must continue to demand that all our space partners comply with current nonproliferation treaties and norms, and continue to ensure adherence to the Missile Technology Control Regime and other non-proliferation guidelines. While it is unlikely that we can halt completely the proliferation of space technology to destabilizing regimes, at a minimum we must make every effort to hinder and slow down the acquisition of such systems.

Many national security space systems have applications in the civil space sector, and vice versa. Our current fleet of ELVs was originally designed and built to meet defense requirements. The Space Shuttle was also designed, in

part, to fulfill military requirements. These government launch systems opened the door for the emergence of commercial launch providers and supported our civil systems. Defense satellites are being used for many civilian applications including air traffic control, general navigation, terrain and feature mapping, global environmental observation, and space debris tracking. The GPS navigation system, developed and operated by the Air Force, was made available for civilian applications when it first became operational. Today, GPS applications abound, and we may one day become as dependent on this technology as we are on the telephone today. GPS assists surveyors, geologists, fishermen, hunters, and campers and is used for auto and truck fleet management and air navigation. The United States has also permitted access to GPS for use in international air traffic control.

President Bush's decision to begin the process of decompartmentalization and declassification of information about the National Reconnaissance Office (NRO) and its capabilities will enable the United States to make better use of those assets. By disseminating information gathered by satellites built and operated by the NRO, we will expand the use of our intelligence-gathering systems into innovative and nontraditional secondary missions such as environmental monitoring. In addition, systems and technology under development for the Strategic Defense Initiative, particularly Brilliant Eyes, can be used to enhance our environmental monitoring program.

Similarly, commercial sector space systems have many national security applications. Commercial communications satellites were used by coalition military forces in Operation Desert Storm. Scientific and commercial Earth-observation systems provided useful low-resolution data for military mapping and broad-area surveillance. In addition, the Department of Defense (DoD) and NOAA regularly exchange space-derived weather data.

Fostering linkages such as these and increasing the synergism between civil and national security space operations are important elements of a successful national space program in the 21st century. The emphasis on space programs within the defense budget must remain strong, because our nation's space assets are a critical force multiplier and the backbone of an effective military capability. In addition, investing in space systems keeps our defense and

commercial industrial base healthy, maintains American leadership in advanced technology, and strengthens the competitiveness of our industry in the international marketplace.

Civil Space

When the history of the 20th century is written, the achievements of America's civil space program will stand among the great events of the era. Mercury, Gemini, Voyager, Viking, and especially Apollo will be recorded as great triumphs of technology, engineering, perseverance, and national will. Through these accomplishments, America has earned the respect and admiration of the world, fired the collective imagination, and inspired our youth. We have produced science and technology that have improved the lives of people around the globe. And we have achieved and maintained our civil space policy goal of space leadership.

At the start of this Administration, however, the civil space program was widely viewed with concern. Recovery from the 1986 Space Shuttle accident had been time-consuming and difficult. A series of widely reported technical problems was sapping public enthusiasm and draining the morale of NASA employees. There was a lack of consensus about where the space program should be going.

Recommendations had been provided to the previous administration by the National Commission on Space, chaired by Dr. Tom Paine. Dr. Sally Ride had also published a report identifying the need for challenging new goals. But the choices called for in these reports had not been made. The National Academy of Sciences and the Center for Strategic and International Studies provided reports to the new administration in 1989. Each called for decisive actions to rejuvenate America's civil space efforts.

As a result, the civil space program was an early and frequent focus of the National Space Council. The Council used a combination of internal policy reviews and external advisory committees to assist in this effort.

Perhaps most notable among these was the Advisory Committee on the Future of the U.S. Space Program, the Augustine Committee. That group, which included many of the nation's most respected space authorities, conducted a far-reaching assessment of the future of the civil space program, including both management issues and program content. The Committee heard from all branches of government, visited many space facilities across the country, and took testimony or otherwise received the advice of hundreds of citizens.

The Committee's recommendations called for fundamental changes in the civil space program. At the core of its conclusions was the recommendation that the space program's goals be organized around two central missions: First, a Mission to Planet Earth, to use space to observe the Earth and its environment to facilitate the study of environmental change and the potential for global warming. Second, a Mission from Planet Earth, to explore space through both human and robotic missions with the goal of returning to the Moon and mounting a human expedition to Mars. The Committee recommended that both missions be supported by a solid base of transportation infrastructure, science, and technology.

The Augustine Committee also recommended a series of management and organizational changes designed to streamline the execution of programs and to focus in the future on smaller, less expensive programs that could be accomplished relatively quickly.

These core recommendations, as well as many other specific program and policy recommendations, were widely endorsed in the space community and in the Congress, formed the basis for many of the Administration's subsequent policy decisions and actions, and have continued to guide both Administration policymakers and department and agency managers.

Mission to Planet Earth

Mission to Planet Earth is an effort to use space-based assets to better understand the Earth as an integrated system by exploring climatic, ecological,

and environmental changes. In recent years we have become acutely aware that human actions, as well as natural phenomena, can affect the environment on a global scale. Space provides a uniquely broad vantage point from which our expertise in remote sensing can be used to determine whether global warming is in fact occurring, to study deforestation and land erosion, and even to detect and examine earthquakes.

The Administration's efforts to support this core element of our civil space program were focused on its two key programmatic elements — the Earth Observing System (EOS) and the Landsat earth remote sensing program.

The Landsat program presented the National Space Council with its first challenge. Landsat remote sensing imagery is important not only for global change research and environmental monitoring, but for national security, law enforcement, natural resource estimates, and a host of commercial enterprises. In early 1989, the program faced termination as a result of a decision in previous years to commercialize the program. This decision had been based on faulty assumptions about private sector demand for Landsat data, and the absence of near-term commercial viability had resulted in a funding crisis.

The National Space Council, meeting for the first time in May 1989, recognized that Landsat data was critical to a host of civil and national security activities as well as to the private sector, and that commercialization of the program would not be feasible in the foreseeable future. It recommended that the government provide near-term operational funding and that a solution be found to ensure the long-term stability of the program, recommendations supported by a Presidential decision.

Subsequent decisions by the Administration, including National Space Policy Directive 5, guaranteed stable funding and management for the program. The Administration and the Congress worked together to enact legislation which will ensure that continuity of Landsat-type data is maintained for the foreseeable future. The legislation will also encourage future commercial opportunities in remote sensing by:

- Supporting investment in new remote sensing technologies,

- Removing unnecessary restrictions on the dissemination of privately gathered data,

- Streamlining the licensing process for private remote sensing systems, and

- Encouraging growth of the market for remote sensing data by pricing federally provided data at the cost of fulfilling user requests, but no higher.

The EOS program presented the Administration with a different set of challenges. EOS is a constellation of satellites, and a complementary data handling system, designed to measure worldwide environmental parameters such as air and ocean temperature, humidity levels, and atmospheric chemistry. It is a key component of the U.S. program for environmental research, an effort in which the United States is investing more resources than the rest of the world combined. The program enjoys broad support within the Administration, the Congress, and the space and environmental communities. It will produce quantities of data an order of magnitude beyond what is currently available, and will provide the basis on which future environmental policies can be based.

However, there was mounting concern that the space-based component of the program was centered around two large, unnecessarily complex and expensive satellites. These two satellites, each carrying a large array of instruments, put large segments of the program at risk of single-point failure, and the entire program at considerable budget and schedule risk.

The Augustine Committee recommended that consideration be given to restructuring the program and deploying, instead, "a combination of different size spacecraft." A panel of technical experts, led by Dr. Edward Frieman, Director of the Scripps Institute of Oceanography, was commissioned to assess this recommendation. The Frieman panel concluded that the two large satellite platforms should be broken down into a series of smaller platforms, each with fewer instruments. This resulted in a Presidential decision, embodied in National Space Policy Directive 7, to redesign the system using an architecture of smaller satellites.

NSPD 7, issued in June 1992, established a comprehensive, multiagency Space-based Global Change Observation System to address global warming and other potentially adverse environmental changes. In addition to directing NASA to develop EOS using small and intermediate-sized satellites, it assigned global change observation functions to various government agencies, and encouraged international cooperation in global change observation. Significantly, classified national security information and archives are now being made available to support our environmental monitoring efforts.

Mission from Planet Earth

NASA's Mission from Planet Earth is nearly as old as NASA itself. Among the first missions the nation embarked upon in the earliest days of the space program were human missions into space, including landings on the Moon, and robotic missions to explore the planets.

At the outset of this Administration, the human exploration component of NASA's Mission from Planet Earth was focused almost exclusively on two programs — the operational Space Shuttle program and the developmental Space Station program. The Space Shuttle is a multipurpose program, but its principal function is to provide transportation to and from space. Secondarily it serves as a temporary laboratory in space, but it lacks the capability to provide the research and scientific data that a permanent Earth-orbiting space station could provide.

The potential benefits of deploying an Earth-orbiting station in space were recognized and understood long before access to space became a reality in the late 1950s. Early space science pioneers, Wernher von Braun and others before him, had conceived of plans for a human outpost in Earth orbit that would be the steppingstone for human exploration of the Moon and the planets. A space station had remained a distant goal throughout the first two decades of the space program.

In 1984, President Reagan approved a plan for NASA to begin development of what is now known as Space Station Freedom. The designs for the Space

Station that had emerged were for a facility that — like the Space Shuttle — would serve many purposes. It would be a laboratory for scientific research on the effects of long-term exposure to a zero-gravity environment on humans, enabling preparation for long-duration human spaceflights. It would serve as a transportation depot for equipment and supplies for other space missions. It would contain laboratories for research on materials processing in space, potentially leading to breakthroughs and applications in chemistry, medicine, and physics. It would be used as a platform for Earth remote sensing and as an astronomical observatory, and provide for a host of other applications.

Amid the multiplicity of demands on both the Space Shuttle and the Space Station, however, there did not exist a clear focus on longer term human exploration goals, nor was there a plan or policy in place that outlined the next incremental step. Where were humans to go next and what were they to do?

On July 20, 1989, the 20th anniversary of the first Apollo Moon landing, President Bush outlined just such a long-term vision for human space exploration by proposing to the nation that it complete Space Station Freedom, then return to the Moon — "this time to stay" — and mount a human expedition to Mars. He directed the National Space Council to begin developing policies and plans to accomplish these objectives.

In March 1990, the President issued the first of several policy decisions on what became known as the Space Exploration Initiative (SEI). In that first decision, he directed that the SEI give early focus to technology development and a search for new and innovative technical approaches. The Moon and Mars missions were to be driven not by schedule, but by investments in high-leverage, innovative technologies that would have the potential to improve mission cost, schedule, and performance and could enhance the nation's technology base. He also directed that several years be invested in defining two or more significantly different mission architectures from which later policymakers could choose, while developing and demonstrating technologies broad enough to support all.

At the request of the Administration, Lt. Gen. Thomas P. Stafford, USAF (Ret), a former astronaut and space pioneer, led a group of technical experts that developed a set of mission architectures and identified key enabling technologies to be developed. Their findings and recommendations are contained in *The Report of the Synthesis Group on America's Space Exploration Initiative*, released in June 1991.

Additionally, the President directed that consideration be given to inviting other nations to participate in SEI, including our partners in Space Station Freedom, other traditional allies, and the former Soviet Union.

Based upon the so-called Synthesis Group report and Presidential decisions, NASA developed a long-term plan for accomplishing Moon and Mars missions. Two near-term precursor orbital missions to the Moon are planned, followed by an unmanned lunar lander. A goal of NASA's longer term plans for manned Moon and Mars missions is to provide significant technology and science benefits to the nation and to challenge young engineers and scientists.

In the meantime, however, the Space Station program had experienced several crises. The initial cost projections had seriously understated the funding requirements for the program. Out-year funding profiles began to grow by significant margins, and the annual appropriations debates in Congress had become increasingly contentious. Several serious attempts to cancel the program were supported by significant numbers of members in both houses, beginning in the late 1980s. During this period, several redesigns of the facility were initiated — some at the direction of Congress — which reduced the Station's costs and capabilities, but the debate continued. A contributing factor was the overall magnitude of the funding requirements combined with a lack of confidence that cost growth would not continue. Another was concern that the Space Shuttle would not be able to perform the relatively large number of flights required to deploy and operate the program.

But central to the debate was the lack of a well-understood program focus. Among the many arguments made was that most of the requirements for the program could be better met by a series of discrete, focused efforts — both on Earth and in space — and at considerably less overall cost.

In early 1991, the National Space Council undertook an overall assessment of the program in the course of a review of NASA's most recent redesign of the facility. It found that the redesign had significantly reduced development costs, had decreased the demands on the Space Shuttle, and had successfully addressed a number of other logistics problems. The Council concluded that though the Space Station will appropriately enable a great deal of valuable scientific research and innovation, the science returns may not, in and of themselves, justify the investment. But most significantly, it concluded that, in any case, pure scientific research was not the compelling rationale for the Space Station. It found that the underlying purpose for building and operating the Space Station is exploration, although the synergism of activities obviously provides greater weight to its overall benefit. Indeed, the Council concluded that the Space Station is the *necessary* next step in space exploration and Mission from Planet Earth. In so doing, it laid the policy foundation on which future deliberations about the Station's merits and purpose can reasonably take place. And more importantly, it reaffirmed the Administration's commitment to build the Space Station and to an aggressive Mission from Planet Earth.

Alongside human exploration, the Mission from Planet Earth component of the civil space program has included a series of exciting robotic explorers. Scientific discoveries gained through missions such as Viking and Voyager provided answers to some of mankind's oldest questions and rank among the greatest accomplishments of the modern age. But during the 1980s, our civil space resources were focused on the development of the Space Shuttle, and funding for robotic exploration was curtailed.

However, a new age of robotic exploration began with the launch of the Magellan mission to Venus in 1989. Magellan was a spectacular success. Galileo is now on its way to Jupiter, and the Mars Observer spacecraft will reach that planet in August 1993. Cassini is being readied for its exploration of Saturn and its moon, Titan. Meanwhile, the Hubble Space Telescope is unlocking secrets of distant galaxies. Additional Great Observatories are planned including the Advanced X-ray Astronomy Facility, which will gather exciting new scientific information about the origin and nature of the universe.

But the size and complexity of this new generation of robotic spacecraft resulted in development programs that stretched out over a decade or more and cost many hundreds of millions and even billions of dollars. Because of the high cost of each program, there were few of them, leaving the careers of many astronomers and planetary scientists heavily dependent on the success of a single spacecraft. And because of the long development times, many scientists will have dedicated large portions of their professional lifetimes to a single project before they receive the first scientific return.

Also, because robotic exploration programs are so few, so large, and so expensive, the consequences of technical problems are magnified. Any single failure can have an enormous scientific impact and can seriously undermine public confidence and support for the space program. Hubble's flawed mirror and Galileo's jammed communications antenna are current examples. For these and other reasons, many promising young students are turning away from space sciences and applying themselves to other disciplines.

The crisis in space science is broadly recognized, and it reflects a problem that needs to be addressed. Beginning right away, new programs should be designed in ways that allow construction and launch to occur in no more than about five years. This will keep costs down and allow a greater number and variety of programs to be conducted. Some of these programs should look outward beyond the region that mankind can aspire to visit — toward Pluto, for example. An increasing share of scientific effort should be focused on learning more about our human exploration goals — the Moon and Mars. As much as any other aspect of the space program, civil science and robotic exploration demand faster, better, and less costly systems.

International Space Activity

The United States has sought to involve foreign partners in its civil space program from its inception. The 1958 National Aeronautics and Space Act, which established NASA, charged it with conducting its activities in ways that contribute "materially to . . . cooperation by the United States with other nations." For more than three decades our cooperative initiatives have

resulted in important and highly successful research missions and space infrastructure programs.

During the four years of the Bush Administration, both the volume and range of our projects with international partners have increased. Indeed, with the exception of advanced technology development and applications projects with commercial potential, virtually every area of NASA activity now involves international partners. The preeminent example of this is Space Station Freedom, the largest international science and technology project ever undertaken, which is currently being developed by the United States along with Europe, Canada, and Japan. Each of our partners has made a large, long-term financial commitment, and Space Station-related work now dominates their overall space programs. Each partner will contribute substantial hardware and expertise to the Station, and all will share responsibility for its operation.

A review of the major projects completed during this past year demonstrates further the degree to which international partnerships have become integral to achievement of our overall national space goals. These included the Topex/Poseidon satellite, a joint U.S./French project to study ocean circulation and its role in regulating global climate, which was successfully launched in August on a European Ariane vehicle; several Space Shuttle missions such as the International Microgravity Laboratory, involving experiments from Canada, Europe, Japan, and the United States, flown in January with an international crew; the first Atmospheric Laboratory for Applications and Science (ATLAS) mission in March, which involved a full complement of international instruments and an international crew; and, a joint U.S./Japanese Spacelab mission in September that involved 34 Japanese experiments and the first Japanese payload specialist flown aboard the Shuttle.

This past year also saw a historic reshaping of our relationship with the republics of the former Soviet Union, particularly Russia. During Russian President Boris Yeltsin's June visit to Washington, Presidents Bush and Yeltsin signed a new space cooperation agreement, which provides the basis for new and important interaction between the world's two major space powers in a wide range of areas — space science, exploration, and applications.

Soon after this agreement was signed, we and the Russians moved swiftly to implement a number of ambitious initiatives that had been proposed during the June meetings. In July, NASA signed a contract with the Russian space entity NPO Energia to study potential application of specialized Russian hardware in our spaceflight and exploration programs, in particular the possible use of the Russian Soyuz-TM vehicle as an interim Assured Crew Return Vehicle for Space Station Freedom. In October, NASA and the Russian Space Agency signed an agreement on a series of joint human spaceflight missions: Russian cosmonauts will fly on the Space Shuttle in November of this year and American astronauts will be aboard the Russian Mir Space Station for as long as 90 days in 1995. Also in 1995, the Space Shuttle will rendezvous and dock with Mir using a Russian docking system that will ultimately be used for Space Station Freedom. In October we signed an agreement on the flight of two U.S. scientific instruments on the Russian Mars '94 mission. All told, 1992 was the most dynamic year of cooperative activity in the history of America's space program.

Not coincidentally, we engaged in this activity with countries that are also among our strongest industrial competitors. Budgetary constraints and the inherent desirability of pursuing certain important goals jointly will continue to increase the pressure for more cooperation with an ever more diverse group of players. Successful partnerships can generate positive results: international good will, a favorable impression of U.S. policies and programs, and a constructive means for demonstrating U.S. scientific and technological leadership. But we cannot lose sight of the elements that form the basis for success — careful integration of first-rate technical and scientific resources and a sense that the interests of all partners have been advanced by virtue of their interaction.

It is important to note that the primary motivation for joint pursuit of space goals is and always has been self-interest. This is true of us and it is true of our partners, old and new alike. It is also true, though often unacknowledged, that the expertise and systems possessed by the world's major space powers are the results of strategic decisions to enhance national scientific, technological, and industrial performance. These strategic objectives, not foreign policy objectives, are now driving space programs

worldwide. The potential partners for important cooperative space activity are now so numerous precisely because their efforts to achieve these objectives have yielded such impressive results. Cooperative projects are assessed by individual countries, in large part, from the standpoint of their potential to advance these objectives further.

Our challenge is to devise policies and procedures that encourage maximum mutually beneficial engagement with international partners across the full range of government and industrial space activity. These policies and procedures may need to be more flexible than those employed in the past, but they cannot be less protective of our national economic and security interests.

Space Commerce and Trade

A separate, nongovernmental commercial space sector was first explicitly addressed in the National Space Policy issued by President Bush in November 1989. That document highlights the value of U.S. commercial space activity by noting that "expanding private sector investment in space by the market-driven commercial sector generates economic benefits for the Nation and supports governmental space sectors with an increasing range of space goods and services."

Total revenue from U.S. commercial space activity was at least $5 billion in 1992 and is growing at a rate of about 20 percent per year. The largest portion of these revenues was generated by the communications satellite industry. The space communications equipment and services industries are the most mature and fastest growing elements of U.S. commercial space activity. Superior technology and manufacturing techniques have made American industry the world leader in this area and secured for it roughly 70 percent of satellite sales to domestic and international customers in 1992. U.S. companies are continuing to develop the most innovative and commercially promising satellite applications.

More recently, space transportation has become another important commercial activity in the United States. Unlike communications satellite systems, which have been privately operated since the 1960s, private entities were only permitted and encouraged to operate space launch systems starting in the early 1980s. The first major private commercial U.S. launch did not take place until August 1989. In contrast to all foreign competitors, U.S. companies have invested more than $700 million of their private capital in vehicle upgrades and infrastructure improvements. These companies have secured roughly 50 percent of the launch contracts competed openly in domestic and international markets.

U.S. leadership in any area of space activity, but particularly commercial space activity, requires technological preeminence. As emphasized elsewhere in this report, the United States is not currently meeting this requirement in the space transportation area. Every major space policy report since 1985 reflects the view expressed in the Aldridge Report: "The failure to fund [a next-generation launch vehicle] is equivalent to an implicit policy decision to forego U.S. competitiveness in space launch and increase the long-term cost to the government." Although we have emphasized commercial activity in our space policy statements, we have tended to lose sight of a fundamental reality in the launch arena: Virtually all launch systems in operation in the world today were developed by governments. And, unlike the United States, all other nations involved in commercial launch either have a highly efficient launch capability or are attempting to develop one.

At the same time, we should not overlook one of this Administration's major commercial space policy accomplishments: recognition that technology development is only one side of the commercial coin. The advantages that can be derived from developing the best technologies — whether in launch systems or spacecraft — will be blunted, if not negated, without rules of fair play in markets for space goods and services. U.S. satellite and launch vehicle manufacturers should have access to foreign customers that is comparable to the access foreign suppliers have to the large domestic U.S. market. We define commercial space activity in the National Space Policy and elsewhere as *nongovernmental*, an element largely unique to the United States. Our satellite and launch vehicle manufacturers are private companies, not state-

owned or -managed enterprises, as is the case not only in China and Russia, but in Europe as well. In all markets in which U.S. companies must compete, domestic and foreign, either their competitors are the beneficiaries of government support that we would consider excessive or improper, or their competitors are governments themselves. In what is, in effect, competition with foreign governments, U.S. firms will have limited success without appropriate international standards regarding subsidies and other forms of government involvement in commercial space activity.

Accordingly, NSPD 2, Commercial Space Launch Policy, calls for both development of new launch technology and establishment of a free and fair commercial launch trading environment which will, in the end, provide a level playing field. Relying on the detailed roadmap provided in that document, U.S agencies, led by the Office of the U.S. Trade Representative, are discussing guidelines and principles for international space trade with Europe, Russia, and China.

With respect to the domestic policy environment, the U.S. Commercial Space Guidelines, issued as NSPD 3 in 1991, are intended to promote the transfer of government-developed technology to the private sector and encourage agencies to participate in cooperative research and development programs with the private sector. This directive also mandates that government agencies use commercially available space products and services to the fullest extent possible; that they make available for commercial use any unused capacity of space assets, services, or infrastructure; and that they implement new acquisition procedures such as "anchor tenancy" to promote commercial space enterprise.

NASA is developing technology for direct commercial application in several areas. It has established 17 Centers for Commercial Development of Space — consortia of government, industry, and academia focusing on research with commercial potential. This program provides vital support to U.S. industry in a number of high-technology markets, including materials research, remote sensing, space power and propulsion, automation and robotics, and life sciences. Among these efforts are development of the Commercial Experiment Transporter system for launching and retrieving space

experiments, and the SPACEHAB module, an example of the government serving as an "anchor tenant" in a privately funded project.

The Defense Advanced Research Projects Agency has continued its unique efforts to encourage commercially promising projects by providing seed funding and developmental assistance. These projects have included the development of small spacecraft experiments, known as lightsats, and the Pegasus launch vehicle.

As important as these efforts to encourage commercial space enterprise have been, more is needed. Our long-standing efforts to streamline government regulations should not only be continued but accelerated. In addition, a Vice President's Space Policy Advisory Board Task Group headed by Daniel J. Fink recently issued a report on *The Future of the U.S. Space Industrial Base* that made several policy recommendations intended to facilitate the growth of the commercial space sector. Among these are changes in our policies on technology exports, export financing, and government procurement; market-opening measures; implementation of a fair-trade agreement; and the encouragement of multiple, small programs for developing space technology. And, echoing the findings of many earlier studies, it emphasized the urgency of developing a new low-cost, reliable launch system that, in addition to meeting U.S. government needs, would be competitive in commercial markets.

Planning for the Future

America's space program is a continuum of activity that stretches back more than three and a half decades. With its origins in the Eisenhower Administration, during a period in which Democrats controlled the Congress, the space program evolved largely independent of partisan influences. The triumphs of human space exploration, new scientific discoveries from a variety of human and robotic programs, and the continuing success of our intelligence and other national security programs are among the nation's greatest achievements.

Our space program was a direct outgrowth of our ideological conflict with the Soviet Union, and it was focused initially on demonstrating America's technological capabilities. As our technology matured, an increasing number of applications were identified and developed, and space is now an integral part of our national security, intelligence, civil, and commercial infrastructure. The activities of the National Space Council over the past four years were predicated on the assumption that space infrastructure is vital to a host of government functions. The Council also believed that space will increasingly contribute to the competitiveness of the U.S. private sector in the international marketplace.

Consequently, the National Space Council, and the government as a whole, have acted to expand activity in space. Regulations have been reduced to encourage commercial opportunities and foster entrepreneurship. New goals have been set for the civil space program, and serious efforts have been

undertaken to reform and revitalize the civil space agency. Military space programs have continued to receive priority for funding and support even as overall defense spending has declined.

The fundamental principles guiding the conduct of U.S. space activities were established nearly 35 years ago. The government's basic policy, and its regulatory and organizational framework, still reflects the international tensions as well as the economic and technological constraints of the past. However, the world has changed in many important respects. The Cold War has ended. We have had a revolution in electronic and other space-related technologies. The international demand for space capabilities has increased along with the proliferation of space technology to other nations. And Operation Desert Storm taught us many new lessons about the military use of space in combat.

These and other factors present new opportunities and new challenges. Overall budget constraints and reduced defense spending have made it necessary, more than ever before, for the United States to ensure that it gets maximum return from its investments in space.

To aid in understanding whether — and what — fundamental changes are necessary to adjust America's space activities to the post-Cold War era, three nonpartisan Task Groups of the Vice President's Space Policy Advisory Board were assembled in mid-1992. The first two Groups, which dealt specifically with the space-related industrial base and with space launch, were discussed earlier in this report. Those assessments provide a foundation for addressing what I believe is the central question facing our space program in the post-Cold War era: How should our space policy be adjusted to respond to a changing world?

To address this question, the third Task Group was formed under the leadership of the Advisory Board Chair, Dr. Laurel Wilkening, the Provost and Vice President for Academic Affairs at the University of Washington, and included policy experts from across the political spectrum. The members brought to this effort hundreds of man-years of experience in civil, military, and commercial space activities. Among its members were prominent

scientists, business leaders, the former chairman of a key congressional committee, retired military leaders, industry leaders, and former government executives, both Democrats and Republicans.

The Task Group's report, *A Post Cold War Assessment of U.S. Space Policy,* concludes that fundamental changes are needed in the way government space activities are organized and managed. The Task Group also found that the United States must take a number of steps needed to foster the competitiveness of its space industries and take the lead in defining a new cooperative strategy for expanded international cooperation in both civil and military space.

The Wilkening Task Group report provides a solid basis for reshaping government policies. While all of these recommendations will require careful implementation and, in a few cases, further study, the Task Group has identified the core issues facing U.S. space policymakers.

On the basis of this report, taking into account many other assessments I have received over the years from both organizations and individuals, and drawing on the individual and collective wisdom of the National Space Council members, I would urge the next administration to consider the following policy and program recommendations:

1. Government Organization

The organizational structure that evolved during the Cold War should be adjusted to encourage greater cooperation and synergism and less duplication among government space activities. A strong White House focus is needed to implement those changes. Sharing technology and systems, consolidating management organizations, and streamlining program review and approval processes can substantially increase the return on investments and maintain America's competitive high-technology edge. Implementing these changes will involve difficult political challenges, but it is essential if the nation is to invest in, and realize the benefits of, new space initiatives in the future.

2. Security and Classification

Current security regulations should be changed. There can be no doubt that strict security protection was necessary to safeguard military and intelligence space activities in the early days of the space program. However, we paid a high price for this security: lack of synergism among government activities, higher than need-be costs, lost opportunities for foreign sales revenues, and restrictions on the use of data for public and private purposes.

With the end of the Cold War, the national security imperative has shifted from the strategic threat posed by the former Soviet Union to the support of U.S. forces engaged in regional conflicts. Relaxed security restrictions can facilitate such operational support. And sharing our capabilities, within prudent limits, with allies and friendly states could deter the proliferation of space technologies, foster U.S. leadership, and enhance our overall national security.

3. Space Control

The proliferation of space capabilities internationally puts U.S. interests and global security at risk. Many nations have learned the lessons of Operation Desert Storm, including the importance of space support to the successful conduct of modern warfare. The United States benefited greatly from the freedom to exploit space in support of coalition forces.

The intelligence community estimates that today, at least 16 nations have some indigenous capability to use space to support their military operations. By the turn of the century, this number could double. We should continue our aggressive efforts to curb the proliferation of these technologies through security and export controls. And carefully crafted cooperative military space agreements will reduce the incentive for some nations to develop indigenous space capabilities. But it is unlikely that we will succeed in denying this capability to all potential adversaries, and we should not gamble that space capabilities will not be used against us in

future regional conflicts. Thus, one unexpected outcome of the end of the Cold War is the increased need to develop and maintain our ability to deny the use of space to our adversaries during a crisis or in wartime. Space control is an area that needs attention and additional investments.

4. Space Industry Regulation

Our space industries evolved to meet the needs of government space program requirements and, as a result, have traditionally been highly regulated. It was an overall policy goal of this Administration to eliminate unnecessary government interference in private enterprise. Our space-related industries are capable of growth and can provide greater economic benefits for the nation if the process of regulatory reform is quickened and expanded. The new administration and the Congress should work together to implement the actions outlined in both the Wilkening and Fink Task Group reports aimed at facilitating this growth. In addition, U.S. agencies should give priority to concluding the pending regulatory proceedings on new satellite technologies and granting the authorizations needed to introduce these technologies into the market.

5. International Cooperation and Trade

In western Europe, Russia, and elsewhere the same fundamental questions are being asked: What should we be trying to achieve in space given the competing demands made for scarce resources? How do we obtain the greatest, most beneficial results from the resources we invest in space? I believe that we can do more, do it faster, and do it at lower cost through carefully structured cooperation with other nations.

Our current national space policy calls for the United States to "conduct international space-related activities expected to achieve significant scientific, political, economic, or national security benefits to the nation." The Wilkening Task Group recently considered our international space policies and concluded that expanded international cooperation presents

us with strategic opportunities. It recommended that the United States take the initiative in shaping a common international agenda in selected areas of civilian and national security space activity.

Expanded international space activity can yield important benefits both for U.S. government space agencies and for U.S. industry. These benefits need not be secured at the expense of our national economic and security interests — interests that must be safeguarded in our dealings with international space cooperative and trading partners. Moreover, transactions involving our space assets should not be used primarily as a means for rewarding or stimulating desirable behavior in other areas.

New or refined policies and procedures should be developed to guide U.S. government agencies and private U.S. firms that engage in international space activity, particularly with respect to proposed activity involving the space organizations of the former Soviet Union. At a minimum, these agencies and firms must understand the limits of their ability to enter into agreements involving purchase or sale of space technology.

With respect to trade in space goods and services, the United States must come to terms with the fact that other spacefaring nations — including Japan, China, Russia, and the Europeans — are determined to establish the strongest possible market presence in all sectors of aerospace trade. We should focus more attention on the issues that will increasingly confront our suppliers of communications satellite equipment as competitive pressures in that area intensify. In the launch area, the effort to establish a multilateral framework for free and fair trade should be accelerated. U.S. agencies must redouble their efforts to achieve this goal and should avoid actions that impede or undermine these efforts.

6. Space Launch

The nation must develop a new, modern space launch capability. As we have stated repeatedly over the past four years, our current ELV systems — Titan, Atlas, and Delta — are aging. They are not responsive to the

needs of spacecraft users. They are expensive to operate, which adds to the cost of military and civil space programs. These systems will become less competitive over time in the international marketplace as new foreign government-developed systems enter that marketplace.

The "Spacelifter" concept recommended by the Vice President's Space Policy Advisory Board represents the kind of capability the nation will need for the 21st century. The time has come to replace our current launch vehicles, and the time to effect this transition is in the early years of the next century when the next generation of several satellite systems being planned today will be ready for launch. If we delay, the nation will be locked into its current expensive systems for another decade or longer, consuming funds and foreclosing new initiatives for another generation. For these reasons, we should plan to phase over to a new launch capability by about the turn of the century.

The Space Shuttle is also aging. It is too expensive to operate and lacks responsiveness. As a result, space transportation consumes too large a share of civil space resources, foreclosing opportunities for new science and new technology initiatives.

I endorse recent efforts to reduce the cost of Space Shuttle operations, but believe they cannot go far enough without sacrificing safety. A serious assessment of human spaceflight options is needed. Our goal should be to begin transitioning to a more cost-effective and efficient human spaceflight system by about 2005 and retire the Space Shuttle program soon thereafter.

7. Space Exploration

The nation should continue to pursue a long-range goal of human space exploration. While Congressional concerns about affordability have delayed funding for the Space Exploration Initiative, the goals of a permanent settlement on the Moon and the human exploration of Mars are both achievable and affordable if managed skillfully. Future science and

technology initiatives should be focused on gaining the knowledge critical to enabling these endeavors.

Space Station Freedom is the essential first step toward human exploration of the solar system. It will be mankind's laboratory in space, providing, among other things, the knowledge of human physiology necessary to support future long-duration space flight.

However, the Space Station will continue to be threatened by political and budget challenges. There have been three concerted efforts in the last years to cancel the program in Congress. If the nation is to have this important capability, there must be confidence that the facility will be completed within its current budget projection and on the schedule currently planned. The management and integration of Space Station is one of the most difficult programmatic challenges facing NASA, and the involvement of foreign partners adds another layer of complexity. Any significant additional cost overruns or schedule delays will put the program at serious risk of termination.

To contain costs, overhead should be reduced by consolidating management responsibility within a single NASA center and by assigning a single contractor with overall responsibility for program integration. Unnecessary supporting activities should also be cancelled.

8. Faster, Cheaper, Better Programs

The size and complexity of future programs, particularly civil science programs, should be constrained. The crisis in space science is primarily the result of too much reliance on too few large projects. The EOS program is among the large and important projects confronting technical and budget challenges.

As originally conceived, the EOS satellites were too complex, cost too much, and took too long to build. Recognizing these problems the Frieman panel identified a number of design and program deficiencies

including the size of the satellites. NASA has begun restructuring EOS along the lines the panel recommended. At a minimum, this restructuring should be completed and *all* the panel's recommendations implemented. Even so, continued vigilance will be required to guard against the temptation to add further capability and complexity to the satellites and their supporting ground processing systems. If not, EOS cost overruns will force the deferral or termination of other important science programs, eliminating the balance that currently exists among scientific missions.

For the future, EOS should have direct oversight at the highest level of management within NASA, and regular external reviews, along the lines of the Frieman panel, should be conducted. New science missions should be designed in ways that allow their construction and launch to occur in no more than about five years. Exercising this discipline will yield more timely data and reduce the probability of schedule delays and cost growth in future programs.

Taken together, this Administration's activities over the last four years have resulted in a forward-looking U.S. space program — one that is vigorous, nonpartisan, and provides for our nation's security and its international competitiveness. Our space program has been strengthened, and a framework and vision for the future have been created. It will be up to the new administration to pick up the challenge, adjust to the new environment, and build on what has come before.

Appendix I

Chronology of Bush Administration Space Policy Activities

April 20, 1989	President signs Executive Order 12675 establishing the National Space Council
June 1, 1989	President announces continuation of the Landsat program.
July 20, 1989	President announces the Space Exploration Initiative.
July 25, 1989	President announces continuation of the National Aerospace Plane Program as a high-priority effort to develop a single-stage-to-orbit vehicle.
November 2, 1989	President announces NSPD 1, National Space Policy.
March 8, 1990	President announces program elements of the Space Exploration Initiative.
March 30, 1990	President announces the United States will explore participation of other nations, including the Soviet Union, in the Space Exploration Initiative.
September 5, 1990	President announces NSPD 2, Commercial Space Launch Policy.
December 17, 1990	*The Report of the Advisory Committee on the Future of the U.S. Space Program*, prepared under the leadership of Norman Augustine, is released.
February 12, 1991	President announces NSPD 3, U.S. Commercial Space Policy Guidelines.
May 17, 1991	Vice President appoints Dr. Laurel Wilkening to serve as Chair of the Vice President's Space Policy Advisory Board.
June 11, 1991	*The Report of the Synthesis Group on America's Space Exploration Initiative*, prepared under the leadership of Thomas Stafford, is released.

July 24, 1991	President announces NSPD 4, National Space Launch Strategy.
September 30, 1991	*Report of the Earth Observing System (EOS) Engineering Review Committee*, prepared under the leadership of Edward Frieman, is released.
February 13, 1992	President announces NSPD 5, Landsat Remote Sensing Strategy.
March 13, 1992	President announces NSPD 6, Space Exploration Initiative Strategy.
June 5, 1992	President announces NSPD 7, Space-based Global Change Observation System.
June 17, 1992	President Bush and Russian President Yeltsin sign cooperation agreement which provides a framework for joint U.S./Russia cooperative projects.
November 19, 1992	Vice President's Space Policy Advisory Board releases a report, prepared by a Task Group led by Daniel J. Fink, *The Future of the U.S. Space Industrial Base.*
November 19, 1992	Vice President's Space Policy Advisory Board releases a report, prepared by a Task Group led by E. C. (Pete) Aldridge, Jr., *The Future of the U.S. Space Launch Capability.*
January 4, 1993	Vice President's Space Policy Advisory Board releases a report, prepared by a Task Group led by Laurel Wilkening, *A Post Cold War Assessment of U.S. Space Policy.*

Appendix II

Executive Order Establishing the National Space Council

Executive Order 12675
April 20, 1989

Establishing the National Space Council

By the authority vested in me as President by the Constitution and laws of the United States of America, and in order to provide a coordinated process for developing a national space policy and strategy and for monitoring its implementation, it is hereby ordered as follows:

Section 1. Establishment and Composition of the National Space Council.

(a) There is established the National Space Council ("the Council").

(b) The Council shall be composed of the following members:

(1) The Vice President, who shall be Chairman of the Council;
(2) The Secretary of State;
(3) The Secretary of the Treasury;
(4) The Secretary of Defense;
(5) The Secretary of Commerce;
(6) The Secretary of Transportation;
(7) The Director of the Office of Management and Budget;
(8) The Chief of Staff to the President;
(9) The Assistant to the President for National Security Affairs;
(10) The Assistant to the President for Science and Technology;
(11) The Director of Central Intelligence; and
(12) The Administrator of the National Aeronautics and Space Administration.

(c) The Chairman shall, from time to time, invite the following to participate in meetings of the Council:

(1) The Chairman of the Joint Chiefs of Staff; and

(2) The heads of other executive departments and agencies and other senior officials in the Executive Office of the President.

Section 2. Functions of the Council.

(a) The Council shall advise and assist the President on national space policy and strategy, and perform such other duties as the President may from time to time prescribe.

(b) In addition, the Council is directed to:

(1) review United States Government space policy, including long-range goals, and develop a strategy for national space activities;

(2) develop recommendations for the President on space policy and space-related issues;

(3) monitor and coordinate implementation of the objectives of the President's national space policy by executive departments and agencies; and

(4) foster close coordination, cooperation, and technology and information exchange among the civil, national security, and commercial space sectors, and facilitate resolution of differences concerning major space and space-related policy issues.

(c) The creation and operation of the Council shall not interfere with existing lines of authority and responsibilities in the departments and agencies.

Section 3. Responsibilities of the Chairman.

(a) The Chairman shall serve as the President's principal advisor on national space policy and strategy.

(b) The Chairman shall, in consultation with the members of the Council, establish procedures for the Council and establish the agenda for Council activities.

(c) The Chairman shall report to the President on the activities and recommendations of the Council. The Chairman shall advise the Council as appropriate regarding the President's directions with respect to the Council's activities and national space policy generally.

(d) The Chairman shall authorize the establishment of such committees of the Council, including an executive committee, and of such working groups, composed of senior designees of the Council members and of other officials invited to participate in Council meetings, as he deems necessary or appropriate for the efficient conduct of Council functions.

Section 4. National Space Policy Planning Process.

(a) The Council will establish a process for developing and monitoring the implementation of national space policy and strategy.

(b) To implement this process, each agency represented on the Council shall provide such information regarding its current and planned space activities as the Chairman shall request.

(c) The head of each executive department and agency shall ensure that its space-related activities conform to national space policy and strategy.

Section 5. Establishment of Vice President's Space Policy Advisory Board.

(a) The Vice President shall establish, in accordance with the provisions of the Federal Advisory Committee Act, as amended (5 U.S.C. App. 2), governing presidential advisory committees, an advisory committee of private citizens to advise the Vice President on the space policy of the United States ("the Board").

(b) The Board shall be composed and function as follows:

(1) The Board shall be composed of members appointed by the Vice President.

(2) The Vice President shall designate a Chairman from among the members of the Board. The Executive Secretary of the National Space Council shall serve as the Secretary to the Board.

(3) Members of the Board shall serve without any compensation for their work on the Board. However, they shall be entitled to travel expenses, including per diem in lieu of subsistence, as authorized by law, for persons serving intermittently in the Government service (5 U.S.C. 5701-5707), to the extent funds are available for that purpose.

(4) Necessary expenses of the Board shall be paid from funds available for the expenses of the National Space Council.

(5) Notwithstanding the provisions of any other Executive Order, the responsibilities of the President under the Federal Advisory Committee Act, as amended, except that of reporting annually to the Congress, which are applicable to the Board established by this order, shall be performed on a reimbursable basis by the Director of the Office of Administration in the Executive Office of the President, in accordance with the guidelines and procedures established by the Administrator of General Services.

Section 6. Microgravity Research Board.

Section 1(c) of Executive Order No. 12660 is amended by deleting "Economic Policy Council" and inserting in lieu thereof "National Space Council."

Section 7. Administrative Provisions.

(a) The Office of Administration in the Executive Office of the President shall provide the Council with such administrative support on a reimbursable basis as may be necessary for the performance of the functions of the Council.

(b) The President shall appoint an Executive Secretary, who shall appoint such staff as may be necessary to assist in the performance of the Council's functions.

(c) All Federal departments, agencies, and interagency councils and committees having an impact on space policy shall extend, as appropriate, such cooperation and assistance to the Council as is necessary to carry out its responsibilities under this order.

(d) The head of each agency serving on the Council or represented on any working group or committee of the Council shall provide such administrative support as may be necessary, in accordance with law and subject to the availability of appropriations, to enable the agency head or its representative to carry out his responsibilities.

Section 8. Reports.

The Council shall submit an annual report setting forth its assessment of and recommendations for the space policy and strategy of the United States Government.

Appendix III

National Space Policy Directives

National Space Policy Directive 1
November 2, 1989

National Space Policy

Introduction

This document contains national policy, guidelines, and implementing actions with respect to the conduct of United States space programs and related activities.

United States space activities are conducted by three separate and distinct sectors: two strongly interacting governmental sectors (Civil and National Security) and a separate, nongovernmental Commercial Sector. Close coordination, cooperation, and technology and information exchange will be maintained among these sectors to avoid unnecessary duplication and promote attainment of United States space goals.

Goals and Principles

A fundamental objective guiding United States space activities has been, and continues to be, space leadership. Leadership in an increasingly competitive international environment does not require United States preeminence in all areas and disciplines of space enterprise. It does require United States preeminence in the key areas of space activity critical to achieving our national security, scientific, technical, economic, and foreign policy goals.

The overall goals of United States space activities are: (1) to strengthen the security of the United States; (2) to obtain scientific, technological, and economic benefits for the general population and to improve the quality of life on Earth through space-related activities; (3) to encourage continuing United States private-sector investment in space and related activities; (4) to promote international cooperative activities, taking into account United States national security, foreign policy, scientific, and economic interests; (5) to cooperate with other nations in maintaining the freedom of space for all activities that enhance the security and welfare of mankind; and, as a long-range goal, (6) to expand human presence and activity beyond Earth orbit into the solar system.

United States space activities shall be conducted in accordance with the following principles:

— The United States is committed to the exploration and use of outer space by all nations for peaceful purposes and for the benefit of all mankind. "Peaceful purposes" allow for activities in pursuit of national security goals.

— The United States will pursue activities in space in support of its inherent right of self-defense and its defense commitments to its allies.

— The United States rejects any claims to sovereignty by any nation over outer space or celestial bodies, or any portion thereof, and rejects any limitations on the fundamental right of sovereign nations to acquire data from space.

— The United States considers the space systems of any nation to be national property with the right of passage through and operations in space without interference. Purposeful interference with space systems shall be viewed as an infringement on sovereign rights.

— The United States shall encourage and not preclude the commercial use and exploitation of space technologies and systems for national economic benefit. These commercial activities must be consistent with national security interests, and international and domestic legal obligations.

— The United States will, as a matter of policy, pursue its commercial space objectives without the use of direct Federal subsidies.

— The United States shall encourage other countries to engage in free and fair trade in commercial space goods and services.

— The United States will conduct international cooperative space-related activities that are expected to achieve sufficient scientific, political, economic, or national security benefits for the Nation. The United States will seek mutually beneficial international participation in space and space-related programs.

Civil Space Policy

The United States civil space sector activities shall contribute significantly to enhancing the Nation's science, technology, economy, pride, sense of well-being and direction, as well as United States world prestige and leadership. Civil sector activities shall comprise a balanced strategy of research, development, operations, and technology for science, exploration, and appropriate applications.

The objectives of the United States civil space activities shall be (1) to expand knowledge of the Earth, its environment, the solar system, and the universe; (2) to create new opportunities for use of the space environment through the conduct of appropriate research and experimentation in advanced technology and systems; (3) to develop space technology for civil applications and, wherever appropriate, make such technology available to the commercial sector; (4) to preserve the United States preeminence in critical aspects of space science, applications, technology, and manned space flight; (5) to establish a permanently manned presence in space; (6) to engage in international cooperative efforts that further United States overall space goals.

Commercial Space Policy

The United States Government shall not preclude or deter the continuing development of a separate nongovernmental Commercial Space Sector. Expanding private sector investment in space by the market-driven Commercial Sector generates economic benefits for the Nation and supports governmental Space Sectors with an increasing range of space goods and services. Governmental Space Sectors shall purchase commercially available space goods and services to the fullest extent feasible and shall not conduct activities with potential commercial applications that preclude or deter Commercial Sector space activities, except for national security or public safety reasons. Commercial Sector space activities shall be supervised or regulated only to the extent required by law, national security, international obligations, and public safety.

National Security Space Policy

The United States will conduct those activities in space that are necessary to national defense. Space activities will contribute to national security objectives by (1) deterring, or if necessary, defending against enemy attack; (2) assuring that forces of hostile nations cannot prevent our own use of space; (3) negating, if necessary, hostile space systems; and (4) enhancing operations of United States and allied forces. Consistent with treaty obligations, the national security space program shall support such functions as command and control, communications, navigation, environmental monitoring, warning, surveillance, and force application (including research and development of programs which support these functions).

Inter-Sector Policies

This section contains policies applicable to, and binding on, the National Security and Civil Space Sectors.

The United States Government will maintain and coordinate separate national security and civil operational space systems where differing needs of the sectors dictate.

Survivability and endurance of national security space systems, including all necessary system elements, will be pursued commensurate with the planned use in crisis and conflict, with the threat, and with the availability of other assets to perform the mission.

Government sectors shall encourage, to the maximum extent feasible, the development and use of United States private sector space capabilities.

A continuing capability to remotely sense the Earth from space is important to the achievement of United States space goals. To ensure that the necessary capability exists, the United States Government will: (a) ensure the continuity of Landsat-type remote sensing data; (b) discuss remote sensing issues and activities with foreign governments operating or regulating the private operation of remote sensing systems; (c) continue government research and development for future advanced remote sensing technologies or systems; and (d) encourage the development of commercial systems, which image the Earth from space, competitive with, or superior to, foreign-operated civil or commercial systems.

Assured access to space, sufficient to achieve all United States space goals, is a key element of national space policy. United States space transportation systems must provide a balanced, robust, and flexible capability with sufficient resiliency to allow continued operations despite failures in any single system. The United States Government will continue research and development on component technologies in support of future transportation systems. The goals of United States space transportation policy are: (1) to achieve and maintain safe and reliable access to, transportation in, and return from, space; (2) to exploit the unique attributes of manned and unmanned launch and recovery systems; (3) to encourage,to the maximum extent feasible, the development and use of United States private sector space transportation capabilities; and (4) to reduce the costs of space transportation and related services.

Communications advancements are critical to all United States space sectors. To ensure necessary capabilities exist, the United States Government will continue research and development efforts for future advanced space communications technologies.

The United States will consider and, as appropriate, formulate policy positions on arms control measures governing activities in space, and will conclude agreements on such measures only if they are equitable, effectively verifiable, and enhance the security of the United States and our allies.

All space sectors will seek to minimize the creation of space debris. Design and operations of space tests, experiments, and systems will strive to minimize or reduce accumulation of space debris consistent with mission requirements and cost-effectiveness. The United States Government will encourage other spacefaring nations to adopt policies and practices aimed at debris minimization.

Implementing Procedures

Normal interagency procedures will be employed wherever possible to coordinate the policies enunciated in this directive.

Executive Order No. 12675 established the National Space Council to provide a coordinated process for developing a national space policy and strategy and for monitoring its implementation.

The Vice President serves as the Chairman of the Council, and as the President's principal advisor on national space policy and strategy. Other members of the Council are the Secretaries of State, Treasury, Defense, Commerce, and Transportation; the Chief of Staff to the President, the Director of the Office of Management and Budget, the Assistant to the President for National Security Affairs, the Assistant to the President for Science and Technology, the Director of Central Intelligence, and the Administrator of the National Aeronautics and Space Administration. The Chairman, from time to time, invites the Chairman of the Joint Chiefs of Staff, the heads of executive agencies, and other senior officials to participate in meetings of the Council.

Policy Guidelines and Implementing Actions

The following Policy Guidelines and Implementing Actions provide a framework through which the policies in this directive shall be carried out. Agencies will use these sections as guidance on priorities, including preparation, review, and execution of budgets for space activities, within the overall resource and policy guidance provided by the President. Affected Government agencies shall ensure that their current policies are consistent with this directive and, where necessary, shall establish policies to implement these practices.

Civil Space Sector Guidelines

Introduction. In conjunction with other agencies: NASA will continue the lead role within the Federal Government for advancing space science, exploration, and appropriate applications through the conduct of activities for research, technology, development, and related operations; National Oceanic and Atmospheric Administration will gather data, conduct research, and make predictions about the Earth's environment; DOT will license and promote commercial launch operations which support Civil Sector operations.

Space Science. NASA, with the collaboration of other appropriate agencies, will conduct a balanced program to support scientific research, exploration, and experimentation to expand understanding of: (1) astrophysical phenomena and the origin and evolution of the universe; (2) the Earth, its environment, and its dynamic relationship with the Sun; (3) the origin and evolution of the solar system; (4) fundamental physical, chemical, and biological processes; (5) the effects of the space environment on human beings; and (6) the factors governing the origin and spread of life in the universe.

Space Exploration. In order to investigate phenomena and objects both within and beyond the solar system, NASA will conduct a balanced program of manned and unmanned exploration.

— Human Exploration. To implement the long-range goal of expanding human presence and activity beyond Earth orbit into the solar system, NASA will continue the systematic development of technologies necessary to enable and support a range of future manned missions. This technology program (Pathfinder) will be oriented toward a Presidential Decision on a focused program of manned exploration of the solar system.

— Unmanned Exploration. NASA will continue to pursue a program of unmanned exploration where such exploration can most efficiently and effectively satisfy national space objectives by, among other things: achieving scientific objectives where human presence is undesirable or unnecessary; exploring realms where the risks or costs of life support are unacceptable; and providing data vital to support future manned missions.

Permanent Manned Presence. NASA will develop the Space Station to achieve permanently manned operational capability by the mid-1990s. Space Station Freedom will: (1) contribute to United States preeminence in critical aspects of manned spaceflight; (2) provide support and stability to scientific and technological investigations; (3) provide early benefits, particularly in the materials and life sciences; (4) promote private sector experimentation preparatory to independent commercial activity; (5) allow evolution in keeping with the needs of Station users and the long-term goals of the United States; (6) provide opportunities for Commercial Sector participation; and (7) contribute to the longer term goal of expanding human presence and activity beyond Earth orbit into the solar system.

Manned Spaceflight Preeminence. Approved programs, such as efforts to improve and safely operate the Space Transportation System (STS) and to develop, deploy, and use the Space Station, are intended to ensure United States preeminence in critical aspects of manned spaceflight.

Space Applications. NASA and other agencies will pursue the identification and development of appropriate applications flowing from their activities. Agencies will seek to promote private sector development and implementation of applications.

— Such applications will create new capabilities, or improve the quality or efficiency of continuing activities, including long-term scientific observations.

— NASA will seek to ensure its capability to conduct selected critical missions through an appropriate mix of assured access to space, on-orbit sparing, advanced automation techniques, redundancy, and other suitable measures.

— Agencies may enter cooperative research and development agreements on space applications with firms seeking to advance the relevant state of the art consistent with United States Government space objectives.

— Management of Federal civil operational remote sensing is the responsibility of the Department of Commerce. The Department of Commerce will: (a) consolidate Federal needs for civil operational remote sensing products to be met either by the private sector or by the Federal Government; (b) identify needed civil operational system research and development objectives; and (c) in coordination with other departments or agencies, provide for the regulation of private sector operational remote sensing systems.

Civil Government Space Transportation. The unique Space Transportation System (STS) capability to provide manned access to space will be exploited in those areas that offer the greatest national return, including contributing to U.S. preeminence in critical aspects of manned spaceflight. The STS fleet will maintain the Nation's capability and will be used to support critical programs requiring manned presence and other unique STS capabilities. In support of national space transportation goals, NASA will establish sustainable STS flight rates to provide for planning and budgeting of Government space programs. NASA will pursue appropriate enhancements to STS operational capabilities, upper stages, and systems for deploying, servicing, and retrieving spacecraft as national and user requirements are defined.

International Cooperation. The United States will foster increased international cooperation in civil space activities by seeking mutually beneficial international participation in civil space and space-related programs. The National Space Council shall be responsible for oversight of civil space cooperation with the Soviet Union. No such cooperative activity shall be initiated until an appropriate interagency review has been completed. U.S. cooperation in international civil space activities will:

— United States participation in international space ventures, whether public or private, must be consistent with U.S. technology transfer laws, regulations, Executive Orders, and Presidential Directives.

— Support the public, nondiscriminatory direct readout of data from Federal civil systems to foreign ground stations and the provision of data to foreign users under specified conditions.

— Be conducted in such a way as to protect the commercial value of intellectual property developed with Federal support. Such cooperation will not preclude or deter commercial space activities by the U.S. private sector, except as required by national security or public safety.

Commercial Space Sector Guidelines

NASA, and the Departments of Commerce, Defense, and Transportation, will work cooperatively to develop and implement specific measures to foster the growth of private sector commercial use

of space. A high-level focus for commercial space issues has been created through establishment of the National Space Council.

To stimulate private sector investment, ownership, and operation of space assets, the U.S. Government will facilitate private sector access to appropriate U.S. space-related hardware and facilities, and encourage the private sector to undertake commercial space ventures. Governmental Space Sectors shall:

— Utilize commercially available goods and services to the fullest extent feasible, and avoid actions that may preclude or deter commercial space sector activities, except as required by national security or public safety. A space good or service is "commercially available" if it is currently offered to a Government service procurement request. "Feasible" means that such goods or services meet mission requirements in a cost-effective manner.

— Enter into appropriate cooperative agreements to encourage and advance private sector basic research, development, and operations while protecting the commercial value of the intellectual property developed.

— Provide for the use of appropriate Government facilities on a reimbursable basis.

— Identify, and eliminate or propose for elimination, applicable portions of United States laws and regulations that unnecessary impede Commercial Space Sector activities.

— Encourage free and fair trade in commercial space activities. Consistent with the goals, principles, and policies set forth in this directive, the United States Trade Representative will consult, or, as appropriate, negotiate with other countries to encourage free and fair trade in commercial space activities. In entering into space-related technology development and transfer agreements with other countries, executive departments and agencies will take into consideration whether such countries practice and encourage free and fair trade in commercial space activities.

— Provide for the timely transfer of Government-developed space technology to the private sector in such a manner as to protect its commercial value, consistent with national security.

— Price Government-provided goods and services consistent with OMB Circular A-25.

National Security Space Sector Guidelines

General:

— The Department of Defense (DoD) will develop, operate, and maintain an assured mission capability through an appropriate mix of robust satellite control, assured access to space, on-orbit sparing, proliferation, reconstitution, or other means.

— The national security space program, including dissemination of data, shall be conducted in accordance with Executive Orders and applicable directives for the protection of national security information and commensurate with both the missions performed and the security measures necessary to protect related space activities.

— DoD will ensure that the national security space program incorporates the support requirements of the Strategic Defense Initiative.

Space Support:

— The National Security Space Sector may use both manned and unmanned launch systems as determined by specific mission requirements. Payloads will be distributed among launch systems and launch sites to minimize the impact of loss of any single launch system or launch site on mission performance. The DoD will procure unmanned launch vehicles or services and maintain launch capability on both the East and West coasts. DoD will also continue to enhance the robustness of its satellite control capability through an appropriate mix of satellite autonomy and survivable command and control, processing, and data dissemination systems.

— DoD will study concepts and technologies which would support future contingency launch capabilities.

Force Enhancement:

— The National Security Space Sector will develop, operate, and maintain space systems and develop plans and architectures to meet the requirements of operational land, sea, and air forces through all levels of conflict commensurate with their intended use.

Space Control:

— The DoD will develop, operate, and maintain enduring space systems to ensure its freedom of action in space. This requires an integrated combination of antisatellite, survivability, and surveillance capabilities.

— Antisatellite (ASAT) Capability. The United States will develop and deploy a comprehensive capability with programs as required and with initial operational capability at the earliest possible date.

— DoD space programs will pursue a survivability enhancement program with long-term planning for future requirements. The DoD must provide for the survivability of selected, critical national security space assets (including associated terrestrial components) to a degree commensurate with the value and utility of the support they provide to national-level decision functions, and military operational forces across the spectrum of conflict.

— The United States will develop and maintain an integrated attack warning, notification, verification, and contingency reaction capability which can effectively detect and react to threats to United States space systems.

Force Application:

— The DoD will, consistent with treaty obligations, conduct research, development, and planning to be prepared to acquire and deploy space systems should national security conditions dictate.

Inter-Sector Guidelines:

The following paragraphs identify selected, high-priority cross-sector efforts and responsibilities to implement plans supporting major United States space policy objectives:

Space Transportation Guidelines:

— The United States national space transportation capability will be based on a mix of vehicles, consisting of the Space Transportation System (STS), unmanned launch vehicles (ULVs), and in-space transportation systems. The elements of this mix will be defined to support the mission needs of National Security and Civil Government Sectors of United States space activities in the most cost-effective manner.

— As determined by specific mission requirements, National Security Space Sector will use the STS and ULVs. In coordination with NASA, the DoD will assure the Shuttle's utility to national defense and will integrate missions into the Shuttle system. Launch priority will be provided for national security missions as implemented by NASA-DoD agreements. Launches necessary to preserve and protect human life in space shall have the highest priority except in times of national security emergency.

— The STS will continue to be managed and operated in an institutional arrangement consistent with the current NASA/DoD Memorandum of Understanding. Responsibility will remain in NASA for operational control of the STS for civil missions, and in the DoD for operational control of the STS for national security missions. Mission management is the responsibility of the mission agency.

— United States commercial launch operations are an integral element of a robust national space launch capability. NASA will not maintain an expendable launch vehicle (ELV) adjunct to the STS. NASA will provide launch services for commercial and foreign payloads only where those payloads must be man-tended, require the unique capabilities of the STS, or it is determined that launching the payloads on the STS is important for national security or foreign policy purposes. Commercial and foreign payloads will not be launched on Government-owned or -operated ELV systems except for national security or foreign policy reasons.

— Civil Government agencies will encourage, to the maximum extent feasible, a domestic commercial launch industry by contracting for necessary ELV launch services directly from the private sector or with DoD.

— NASA and the DoD will continue to cooperate in the development and use of military and civil space transportation systems and avoid unnecessary duplication of activities. They will pursue new launch and launch support concepts aimed at improving cost-effectiveness, responsiveness, capability, reliability, availability, maintainability, and flexibility. Such cooperation between the National Security and Civil Sectors will ensure efficient and effective use of national resources.

Guidelines for the Federal Encouragement of Commercial Unmanned Launch Vehicles (ULVs):

— The United States Government fully endorses and will facilitate the commercialization of United States unmanned launch vehicles (ULVs).

— The Department of Transportation (DOT) is the lead agency within the Federal Government for developing, coordinating, and articulating Federal policy and regulatory guidance pertaining to United States commercial launch activities in consultation with DoD, State, NASA, and other

concerned agencies. All executive departments and agencies shall assist the DOT in carrying out its responsibilities, as set forth in the Commercial Space Launch Act and Executive Order 12465.

— The United States Government encourages the use of its launch and launch-related facilities for United States commercial launch operations.

— The United States Government will have priority use of Government facilities and support services to meet national security and critical mission requirements. The United States Government will make all reasonable efforts to minimize impacts on commercial operations.

— The United States Government will not subsidize the commercialization of ULVs, but will price the use of its facilities, equipment, and services with the goal of encouraging viable commercial ULV activities in accordance with the Commercial Space Launch Act.

— The United States Government will encourage free market competition within the United States private sector. The United States Government will provide equitable treatment for all commercial launch operators for the sale or lease of Government equipment and facilities consistent with its economic, foreign policy, and national security interests.

— NASA and DoD, for those unclassified and releasable capabilities for which they have responsibility, shall, to the maximum extent feasible:

  — Use best efforts to provide commercial launch firms with access, on a reimbursable basis, to national launch and launch-related facilities, equipment, tooling, and services to support commercial launch operations;

  — Develop, in consultation with the DOT, contractual arrangements covering access by commercial launch firms to national launch and launch-related property and services they request in support of their operations;

  — Provide technical advice and assistance to commercial launch firms on a reimbursable basis, consistent with the pricing guidelines herein; and

  — Conduct, in coordination with DOT, appropriate environmental analyses necessary to ensure that commercial launch operations conducted at Federal launch facilities are in compliance with the National Environmental Policy Act.

Government ULV Pricing Guidelines:

The price charged for the use of United States Government facilities, equipment, and service will be based on the following principles:

— Price all services (including those associated with production and launch of commercial ULVs) based on the direct costs incurred by the United States Government. Reimbursement shall be credited to the appropriation from which the cost of providing such property or service was paid.

— The United States Government will not seek to recover ULV design and development costs or investments associated with any existing facilities or new facilities required to meet United States Government needs to which the U.S. Government retains title.

— Tooling, equipment, and residual ULV hardware on hand at the completion of the United States Government's program will be priced on a basis that is in the best overall interest of the United States Government, taking into consideration that these sales will not constitute a subsidy to the private sector operator.

Commercial Launch Firm Requirements:

Commercial launch firms shall:

— Maintain all facilities and equipment leased from the United States Government to a level of readiness and repair specified by the United States Government.

— ULV operators shall comply with all requirements of the Commercial Space Launch Act, all regulations issued under the Act, and all terms, conditions, or restrictions of any license issued or transferred by the Secretary of Transportation under the Act.

Technology Transfer Guidelines:

— The United States will work to stem the flow of advanced Western space technology to unauthorized destinations. Executive departments and agencies will be fully responsible for protecting against adverse technology transfer in the conduct of their programs.

— Sales of United States space hardware, software, and related technologies for use in foreign space projects will be consistent with relevant international and bilateral agreements and arrangements.

Space Infrastructure

All Sectors shall recognize the importance of appropriate investments in the facilities and human resources necessary to support United States space objectives and maintain investments that are consistent with such objectives. The National Space Council will conduct a feasibility study of alternate methods for encouraging private sector investment, including capital funding, of United States space infrastructure such as ground facilities, launcher developments, and orbital assembly and test facilities.

— The primary forum for negotiations on nuclear and space arms is the Nuclear and Space Talks (NST) with the Soviet Union in Geneva. The instructions to the United States Delegation will be consistent with this National Space Policy Directive, established legal obligations, and additional guidance by the President. The United States will continue to consult with its allies on these negotiations and ensure that any resulting agreements enhance the security of the United States and its allies. Any discussions on arms control relating to activities in space in forums other than NST must be consistent with, and subordinate to, the foregoing activities and objectives.

National Space Policy Directive 2
September 5, 1990

Commercial Space Launch Policy

Policy Findings

A commercial space launch industry can provide many benefits to the U.S., including indirect benefits to U.S. national security.

The long-term goal of the United States is a free and fair market in which U.S. industry can compete. To achieve this, a set of coordinated actions is needed for dealing with international competition in launch goods and services in a manner that is consistent with our nonproliferation and technology transfer objectives. These actions must address both the short term (actions which will affect competitiveness over approximately the next ten years) and those which will have their principal effect in the longer term (i.e., after approximately the year 2000).

— In the near term, this includes trade agreements and enforcement of those agreements to limit unfair competition. It also includes the continued use of U.S.-manufactured launch vehicles for launching U.S. Government satellites.

— For the longer term, the United States should take actions to encourage technical improvements to reduce the cost and increase the reliability of U.S. space launch vehicles.

Implementing Actions

U.S. Government satellites will be launched on U.S.-manufactured launch vehicles unless specifically exempted by the President.

Consistent with guidelines to be developed by the National Space Council, U..S. Government agencies will actively consider commercial space launch needs and factor them into their decisions on improvements in launch infrastructure and launch vehicles aimed at reducing cost, and increasing responsiveness and reliability, of space launch vehicles.

The U.S. Government will enter into negotiations to achieve agreement with the European Space Agency (ESA), ESA member states, and others as appropriate, which defines principles of free and fair trade.

Nonmarket launch providers of space launch goods and services create a special case because of the absence of market-oriented pricing and cost structures. To deal with their entry into the market, there needs to be a transition period during which special conditions may be required.

There also must be an effective means of enforcing international agreements related to space launch goods and services.

National Space Policy Directive 3
February 12, 1991

U.S. Commercial Space Policy Guidelines

A fundamental objective guiding United States space activities has been space leadership, which requires preeminence in key areas of space activity. In an increasingly competitive international environment, the U.S. Government encourages the commercial use and exploitation of space technologies and systems for national economic benefit. These efforts to encourage commercial activities must be consistent with national security and foreign policy interests; international and domestic legal obligations, including U.S. commitments to stem missile proliferation; and agency mission requirements.

United States space activities are conducted by three separate and distinct sectors: two U.S. Government sectors — the civil and national security — and a nongovernmental commercial space sector. The commercial space sector includes a broad cross section of potential providers and users, including both established and new market participants. There also has been a recent emergence of State government initiatives related to encouraging commercial space activities. The commercial space sector is comprised of at least five market areas, each encompassing both Earth- and space-based activities, with varying degrees of market maturity or potential:

Satellite Communications - the private development, manufacture, and operation of communications satellites and marketing of satellite telecommunications services, including position location and navigation;

Launch and Vehicle Services - the private development, manufacture, and operation of launch and reentry vehicles, and the marketing of space transportation services;

Remote Sensing - the private development, manufacture, and operation of remote sensing satellites and the processing and marketing of remote sensing data;

Materials Processing - the experimentation with, and production of, organic and inorganic materials and products utilizing the space environment; and

Commercial Infrastructure - the private development and provision of space-related support facilities, capabilities, and services.

In addition, other market-driven commercial space sector opportunities are emerging.

The U.S. Government encourages private investment in, and broader responsibility for, space-related activities that can result in products and services that meet the needs of Government and other customers in a competitive market. As a matter of policy, the U.S. Government pursues its commercial space objectives without the use of direct Federal subsidies. A robust commercial space sector has the potential to generate new technologies, products, markets, jobs, and other economic benefits for the Nation, as well as indirect benefits for national security.

Commercial space sector activities are characterized by the provision of products and services such that:

— private capital is at risk;

— there are existing, or potential, nongovernmental customers for the activity;

— the commercial market ultimately determines the viability of the activity; and

— primary responsibility and management initiative for the activity resides with the private sector.

Implementing Guidelines

The following implementing guidelines shall serve to provide the U.S. private sector with a level of stability and predictability in its dealings with agencies of the U.S. Government. The agencies will work separately but cooperatively, as appropriate, to develop specific measures to implement this strategy. U.S. Government agencies shall, consistent with national security and foreign policy interests, international and domestic legal obligations, and agency mission requirements, encourage the growth of the U.S. commercial space sector in accordance with the following guidelines:

- U.S. Government agencies shall utilize commercially available space products and services to the fullest extent feasible. This policy of encouraging U.S. Government agencies to purchase, and the private sector to sell, commercial space products and services has potentially large economic benefits.

  — A space product or service is "commercially available" if it is currently offered commercially, or if it could be supplied commercially in response to a Government procurement request.

  — "Feasible" means that products and services meet mission requirements in a cost-effective manner.

  — "Cost-effective" generally means that the commercial product or service costs no more than governmental development or directed procurement where such Government costs include applicable Government labor and overhead costs, as well as contractor charges and operations costs.

  — However, the acquisition of commercial space products and services shall generally be considered cost effective if they are procured competitively using performance-based contracting techniques. Such contracting techniques give contractors the freedom and financial incentive to achieve economies of scale by combining their Government and commercial work, as well as increased productivity through innovation.

— U.S. Government agencies shall actively consider, at the earliest appropriate time, the feasibility of their using commercially available products and services in agency programs and activities.

— U.S. Government agencies shall continue to take appropriate measures to protect from disclosure any proprietary data which is shared with the U.S. Government in the acquisition of commercial space products and services.

- U.S. Government agencies shall promote the transfer of U.S. Government-developed technology to the private sector.

  — U.S. Government-developed unclassified space technology will be transferred to the U.S. commercial space sector in as timely a manner as possible and in ways that protect its commercial value.

  — U.S. Government agencies may undertake cooperative research and development activities with the private sector, as well as State and local governments, consistent with policies and funding, in order to fulfill mission requirements in a manner which encourages the creation of commercial opportunities.

  — With respect to technologies generated in the performance of Government contracts, U.S. Government agencies shall obtain only those rights necessary to meet Government needs and mission requirements, as directed by Executive Order 12591.

- U.S. Government agencies may make unused capacity of space assets, services, and infrastructure available for commercial space sector use.

  — Private sector use of U.S. Government agency space assets, services, and infrastructure shall be made available on a reimbursable basis consistent with OMB Circular A-25 or appropriate legislation.

- U.S. Government agencies may make available to the private sector those assets which have been determined to be excess to the requirements of the U.S. Government in accordance with U.S. law and applicable international treaty obligations. Due regard shall be given to the economic impact such transfer may have on the commercial space sector, promoting competition, and the long-term public interest.

- The U.S. Government shall avoid regulating domestic space activities in a manner that precludes or deters commercial space sector activities, except to the extent necessary to meet international and domestic legal obligations, including those of the Missile Technology Control Regime.

Accordingly, agencies shall identify, and propose for revision or elimination, applicable portions of U.S. laws and regulations that unnecessarily impede commercial space sector activities.

- U.S. Government agencies shall work with the commercial space sector to promote the establishment of technical standards for commercial space products and services.

- U.S. Government agencies shall enter into appropriate cooperative agreements to encourage and advance private sector basic research, development, and operations. Agencies may reduce initial private sector risk by agreeing to future use of privately supplied space products and services where appropriate.

  — "Anchor tenancy" is an example of such an arrangement, whereby U.S. Government agencies can provide initial support to a venture by contracting for enough of the future product or service to make the venture viable in the short term. Long-term viability and growth must come primarily from the sale of the product or service to customers outside the U.S. Government.

  — There must be demonstrable U.S. Government mission or program requirements for the proposed commercial space good or service. In assessing the U.S. Government's mission or program requirements for these purposes, the procuring agency may consider consolidating all anticipated U.S. Government needs for the particular product or service, to the maximum extent feasible.

  — U.S. Government agencies entering into such arrangements may take action, consistent with current policies and funding availability, to provide compensation to commercial space providers for future termination of missions for which the products or services were required.

- The United States will work toward establishment of an international trading environment that encourages market-oriented competition by working with its trading partners to:

  — Establish clear principles for international space markets that provide an atmosphere favorable to stimulating greater private investment and market development;

  — Eliminate direct Government subsidies and other unfair practices that undermine normal market competition among commercial firms;

  — Eliminate unfair competition by governments for business in space markets consistent with domestic policies that preclude or deter U.S. Government competition with commercial space sector activities.

The U.S. Commercial Space Policy Guidelines are consistent with the National Space Policy and the U.S. Commercial Space Launch Policy, which remain fully applicable to activities of the governmental space sectors and the commercial space sector.

Reporting Requirements

U.S. Government agencies affected by these guidelines are directed to report by October 1, 1991, to the National Space Council on their activities related to the implementation of these policy guidelines.

National Space Policy Directive 4
July 24, 1991

National Space Launch Strategy

Introduction

National space policy provides a framework within which agencies plan and conduct U.S. Government space activities. The National Space Launch Strategy provides guidance for implementation of that policy with respect to access to and from space.

Assured access to space is a key element of U.S. national space policy and a foundation upon which U.S. civil, national security, and commercial space activities depend.

United States space launch infrastructure, including launch vehicles and supporting facilities, should: (1) provide safe and reliable access to, transportation in, and return from space; (2) reduce the costs of space transportation and related services, thus encouraging expanded space activities; (3) exploit the unique attributes of manned and unmanned launch and recovery systems; and (4) encourage, to the maximum extent feasible, the development and growth of U.S. private sector space transportation capabilities which can compete internationally.

Space Launch Strategy

The National Space Launch Strategy is composed of four elements:

(1) Ensuring that existing space launch capabilities, including support facilities, are sufficient to meet U.S. Government manned and unmanned space launch needs.

(2) Developing a new unmanned, but man-rateable, space launch system to greatly improve national launch capability with reductions in operating costs and improvements in launch system reliability, responsiveness, and mission performance.

(3) Sustaining a vigorous space launch technology program to provide cost-effective improvements to current launch systems, and to support development of advanced launch capabilities, complementary to the new launch system.

(4) Actively considering commercial space launch needs and factoring them into decisions on improvements in launch facilities and launch vehicles.

These strategy elements will be implemented within the overall resource and policy guidance provided by the President.

Strategy Guidelines

Existing Space Launch Capability

(1) A mixed fleet comprised of the Space Shuttle and existing expendable launch vehicles will be the primary U.S. Government means to transport people and cargo to and from space through the current decade and will be important components of the Nation's launch capability well into the first decade of the 21st century.

(2) To meet U.S. Government needs, agencies will conduct programs to systematically maintain and improve the Space Shuttle, current U.S. expendable launch vehicle fleets, and supporting launch site facilities and range capabilities. Such programs shall be cost-effective relative to current and programmed mission needs and to investments in new launch capabilities.

(3) As the Nation is moving toward development of a new space launch system, the production of additional Space Shuttle orbiters is not planned. The production of spare parts should continue in the near term to support the existing Shuttle fleet, and to preserve an option to acquire a replacement orbiter in the event of an orbiter loss or other demonstrable need. By continuing to operate the Shuttle conservatively, by taking steps to increase the reliability and lifetime of existing orbiters, and by developing a new launch system, the operational life of the existing orbiter fleet will be extended. The Space Shuttle will be used only for those important missions that require manned presence or other unique Shuttle capabilities, or for which use of the Shuttle is determined to be important for national security, foreign policy, or other compelling purposes.

(4) Consistent with U.S. national security and national space policy, the U.S. Government may seek to recover residual value from ballistic missiles which are, or subsequently become, surplus to the needs of the Department of Defense. Prior to any release of such missiles, including components, beyond those already approved for use as space launch vehicles, the Department of Defense will conduct, and the National Space Council and the National Security Council will review, an assessment of alternative disposition options for such missiles.

Disposition options will be evaluated in terms of their consistency with U.S. national security and foreign policy interests, available agency resources, defense industrial base considerations, and with due regard to economic impact on the commercial space sector, promoting competition, and the long-term public interest.

New Space Launch System

(1) The Department of Defense and the National Aeronautics and Space Administration will undertake the joint development of a new space launch system to meet civil and national security needs. The goal of this launch program is to greatly improve national launch capability with reductions in operating costs and improvements in launch system reliability, responsiveness, and mission performance.

(2) The new launch system, including manufacturing processes and production and launch facilities, will be designed to support a range of medium- to heavy-lift performance requirements and to facilitate evolutionary change as requirements evolve. The design may take advantage of existing components from both the Space Shuttle and existing expendable rockets in order to expedite initial capability and reduce development costs. While initially unmanned, the new launch system will be designed to be man-rateable in the future.

(3) The new launch system will be managed, funded, and developed jointly by the Department of Defense and the National Aeronautics and Space Administration. The development program will be structured in the near term toward the goal of a first flight in 1999. However, the program should allow for several schedule options for the first flight and should identify key intermediate milestones. Since the new launch system will provide the opportunity for significant long-term benefits to the commercial space launch industry, the agencies should actively explore the potential for U.S. private sector participation. Final decisions on the program schedule, including the date of the first flight, will be made during fiscal year 1993, based on updated requirements and technical and budgetary considerations at that time. A joint program plan will be prepared by the Department of Defense and the National Aeronautics and Space Administration and reviewed by the National Space Council.

(4) The Department of Defense and the National Aeronautics and Space Administration will plan for the transition of selected space programs from current launch systems to the new launch system at appropriate program milestones to insure mission continuity and to minimize satellite and other transition costs.

Space Launch Technology

(1) In addition to conducting the focused development program for a new launch system, appropriate U.S. Government agencies will continue to conduct broadly based research and focused technology programs to support long-term improvements in national space launch capabilities. This technology effort shall address launch system components (e.g., engines, materials, structures, avionics); upper stages; improved launch processing concepts; advanced

launch system concepts (e.g., single-stage-to-orbit concepts, including the National AeroSpace Plane); and experimental flight vehicle programs.

(2) The Department of Defense, the Department of Energy, and the National Aeronautics and Space Administration will coordinate space launch technology efforts and, by December 1, 1991, jointly prepare a 10-year space launch technology plan.

Commercial Space Launch Considerations

(1) In addition to addressing Government needs, improvement of space launch capabilities can facilitate the ability of the U.S. commercial space launch industry to compete. Consistent with U.S. space policy, U.S. Government agencies will actively consider commercial space launch needs and factor them into decisions on existing space launch capabilities, development of a new space launch system, and implementation of space launch technology programs in the following ways:

(a) U.S. Government-funded investments will be consistent with approved budgets and U.S. Government requirements.

(b) U.S. Government agencies, in acquiring space launch-related capabilities, should:

[1] Allow contractors, to the fullest extent feasible, the flexibility to accommodate commercial needs when developing launch vehicles and infrastructure to meet Government needs.

[2] Emphasize procurement strategies which are based on: "best value" rather than lowest cost, performance-based functional requirements, commercial production and quality-assurance standards and techniques, and the use of commercially offered space products and services.

[3] Encourage commercial and State and local government investment and participation in the development and improvement of U.S. launch systems and facilities.

[4] Provide for private sector retention of technical data rights, except those rights necessary to meet Government needs or to comply with statutory responsibilities.

(c) U.S. Government agencies should seek to remove, where appropriate, legal or administrative impediments to private sector arrangements such as industry teams, consortia, cost-sharing, and joint production agreements which may benefit U.S.

Government needs and economic competitiveness. Agencies should also seek legislative authority for stable long-term commitments to purchase space transportation services.

(d) Within applicable law, U.S. Government agencies are encouraged to use industry advisory groups to facilitate the identification of commercial space launch needs and the elimination of barriers that unnecessarily impede commercial space launch activities. U.S. agencies are also encouraged to consult with State and local governments.

(2) U.S. Government agencies should develop explicit provisions to implement these guidelines for actively considering commercial space launch needs. As appropriate, agencies should solicit public views on these provisions.

Reporting Requirements

U.S. Government agencies affected by these strategy guidelines are directed to report by December 1, 1991, to the National Space Council on their activities related to the implementation of these policies.

National Space Policy Directive 5
February 13, 1992

Landsat Remote Sensing Strategy

Policy Goals

A remote sensing capability such as is currently being provided by Landsat satellites 4 and 5 benefits the civil and national security interests of the United States and makes contributions to the private sector which are in the public interest. For these reasons, the United States Government will seek to maintain continuity of Landsat-type data. The U.S. Government will:

a. Provide data which are sufficiently consistent in terms of acquisition geometry, coverage characteristics, and spectral characteristics with previous Landsat data to allow comparisons for change detection and characterization;

b. Make Landsat data available to meet the needs of national security, global change research, and other Federal users; and,

c. Promote and not preclude private sector commercial opportunities in Landsat-type remote sensing.

Landsat Strategy

The Landsat strategy is composed of the following elements:

(1) Ensuring that Landsat satellites 4 and 5 continue to provide data as long as they are technically capable of doing so, or until Landsat 6 becomes operational.

(2) Acquiring a Landsat 7 satellite with the goal of maintaining continuity of Landsat-type data beyond the projected Landsat 6 end of life.

(3) Fostering the development of advanced remote sensing technologies, with the goal of reducing the cost and increasing the performance of future Landsat-type satellites to meet U.S. Government needs, and potentially, enabling substantially greater opportunities for commercialization.

(4) Seeking to minimize the cost of Landsat-type data for U.S. Government agencies and to provide data for use in global change research in a manner consistent with the Administration's Data Management for Global Change Research Policy Statements.

(5) Limiting U.S. Government regulations affecting private sector remote sensing activities to only those required in the interest of national security, foreign policy, and public safety.

(6) Maintaining an archive, within the United States, of existing and future Landsat-type data.

(7) Considering alternatives for maintaining continuity of data beyond Landsat 7.

These strategy elements will be implemented within the overall resource and policy guidance provided by the President.

Implementing Guidelines

The Department of Commerce will:

(1) Complete and launch Landsat 6.

(2) In coordination with OMB, arrange for the continued operation of Landsat satellites 4 and 5 until Landsat 6 becomes operational.

The Department of Defense and the National Aeronautics and Space Administration will:

(1) Develop and launch a Landsat 7 satellite of at least equivalent performance to replace Landsat 6 and define alternatives for maintaining data continuity beyond Landsat 7.

(2) Prepare a plan by March 1, 1992, which addresses management and funding responsibilities, operations, data archiving and dissemination, and commercial considerations associated with the Landsat program. This plan will be coordinated with other U.S. Government agencies, as appropriate, and reviewed by the National Space Council.

(3) With the support of the Department of Energy and other appropriate agencies, prepare a coordinated technology plan that has as its goals improving the performance and reducing the cost for future Landsat-type remote sensing systems.

The Department of the Interior will continue to maintain a national archive of Landsat-type remote sensing data.

Affected agencies will identify funds, within their approved fiscal year 1993 budget, necessary to implement this strategy.

Reporting Requirements

U.S. Government agencies affected by these strategy guidelines are directed to report by March 15, 1992, to the National Space Council on the implementation of this strategy.

National Space Policy Directive 6
March 13, 1992

Space Exploration Initiative Strategy

Introduction

The Space Exploration Initiative Strategy approves the next in a series of steps to be taken by the National Aeronautics and Space Administration (NASA), the Department of Defense (DoD), the Department of Energy (DOE), and other Federal agencies regarding the planning for, and conduct of, the Nation's Space Exploration Initiative (SEI), which includes both Lunar and Mars elements, manned and robotic missions, and supporting technology. This series of steps augments previous Presidential Directives and recognizes the recommendations of both the Advisory Committee on the Future of the U.S. Space Program and the SEI Synthesis Group. The exploration of space is one of the fundamental goals of the U.S. civil space program. The SEI objectives, which build upon previous accomplishments, as well as upon existing programs, include a return to the Moon — this time to stay — and human expeditions to Mars. In addition, the objectives will provide a strategic framework for the conduct of the U.S. civil space program and will help focus investments in many areas of goal-oriented research and development by government, industry, and academia. Consistent with the Commercial Space Policy this framework is also intended to encourage private sector activities which augment or support the SEI objectives.

NASA is the principal implementing agency for the SEI. DoD and DOE, as participating agencies, will have major roles in support of the SEI in the conduct of technology development and concept definition. Other U.S. Government agencies are encouraged to participate by developing activities supportive of the SEI.

Exploration Responsibilities and Actions

To establish a firm foundation and clear direction for the SEI, the following actions shall be undertaken immediately:

a. NASA shall establish an exploration office headed by the Associate Administrator for Exploration and staffed by NASA and representatives from other participating agencies. The Associate Administrator shall be responsible for architecture and mission studies, planning, and program execution, as well as the definition of resulting requirements for research, technology, infrastructure, mission elements, and program implementation. As director of the exploration office, the Associate Administrator shall prepare an annual status report. The NASA Administrator shall present this report to the National Space Council.

b. Working with participating agencies, NASA's Associate Administrator for Exploration shall develop a strategic plan for the SEI to establish the basis for integrating existing and future SEI-related activities. This plan shall address research, technology development, and operations and identify the relationships between the SEI mission elements and the U.S. space infrastructure.

c. A Steering Committee for Space Exploration shall be established, chaired by NASA's Associate Administrator for Exploration, and shall include representation from participating agencies. The

Committee shall be the senior interagency forum for coordinating organizational interfaces, reports, plans and activities, and SEI-related programs and budgets, and for identifying those issues requiring consideration by the National Space Council. The Department of State shall participate in any meetings of the Committee related to international cooperation or other international activity.

Exploration Guidelines

To insure that necessary preparatory activities are accomplished, the following steps shall be taken:

a. The participating agencies shall address critical, long-lead research and technology development activities which are supportive of the exploration strategic plan.

b. The Department of Commerce and other appropriate agencies shall encourage the development of SEI-related proposals which foster private sector investments, ownership, and operation of space-related projects and ventures, as well as promote U.S. economic competitiveness. These agencies shall seek increased cooperation with the private sector through mechanisms such as technology transfer agreements, cooperative research and development agreements, and consortia, as appropriate.

c. Exploration requirements shall be incorporated into the evolutionary plans for the new national launch system.

d. NASA, DoD, and DOE shall continue technology development for space nuclear power and propulsion while ensuring that these activities are performed in a safe and environmentally acceptable manner and consistent with existing laws and regulations, treaty obligations, and agency mission requirements.

e. NASA and appropriate participating agencies shall implement a definitive life science program in support of the human exploration of the Moon and Mars.

f. All participating agencies should include space exploration in their respective educational programs. In addition, participating agencies shall take advantage of university research capabilities and cooperative education programs in SEI-related activities.

g. International cooperation in this endeavor is feasible and could offer significant benefits to the United States, subject to the satisfaction of national security, foreign policy, scientific, and economic interests.

h. Expanding on individual agency efforts to improve and streamline acquisition procedures, the Associate Administrator for Exploration, and participating agencies, shall work with the Office of Management and Budget and the Office of Federal Procurement Policy to develop improved U.S. Government procurement practices available for SEI acquisition.

i. The exploration office shall seek innovative ideas by encouraging input from all sectors of American society.

Reporting Requirements

a. By November 1992, the first annual status report shall be presented to the National Space Council. It shall address options for exploration architectures and initial capabilities.

b. The initial version of the Strategic Plan for the Space Exploration Initiative shall be presented to the National Space Council by April 1992, and updated regularly thereafter. The initial version shall focus on technology development and alternate mission architectures.

National Space Policy Directive 7
June 5, 1992

Space-based Global Change Observation

Introduction

The U.S. Global Change Research Program (USGCRP) is a key component of the Nation's overall approach to global stewardship and is one of the Nation's highest priority science programs. This program's goal is to provide a sound scientific basis for developing national and international policy relating to natural and human-induced changes in the Earth system. The ultimate success of the USGCRP depends upon an integrated set of ground- and space-based observation and research programs. The United States is planning and implementing a series of satellite missions that include NASA's Mission to Planet Earth, related environmental satellites, and activities of other agencies to provide these global observations for the next several decades. For the purposes of this document, these systems are collectively referred to as the Space-based Global Change Observation System (S-GCOS).

Objectives

a. General

The Space-based Global Change Observation System will provide space-based global observations which, together with other observations and studies, coordinated through the U.S. Global Change Research Program, will provide the scientific information to help understand the Earth system.

b. Specific

In support of the USGCRP, the S-GCOS shall:

1. Improve our ability to detect and document changes in the global climate system to determine, as soon as possible, whether there is global warming or other potentially adverse global environmental changes; and, if changes are detected, determine the magnitude of these changes and identify their causes.

2. Provide data to help identify and understand the complex interactions that characterize the Earth system in order to anticipate changes and differentiate between human-induced and natural processes.

3. Provide for a data system to manage the information collected by S-GCOS as an integral part of the Global Change Data and Information System, consistent with the USGCRP data policy.

4. Provide for the development and demonstration of new space-based remote sensing technologies for global change observation and identify candidate technologies for future operational use.

Implementing Actions

This directive provides guidance to agencies developing, deploying, operating, or supporting S-GCOS elements to acquire and manage relevant observations and data sets for the USGCRP.

a. International Cooperation

It is recognized that the goals and objectives of the U.S. Global Change Research Program can best be achieved through the mutually reinforcing research of all nations and many organizations and programs, which require a large measure of bilateral and multilateral cooperation. Accordingly, participating agencies may explore, in accordance with this directive and established procedures, international cooperation in space-based global change observation.

b. Interagency Coordination

Space-based Global Change Observation System activities are conducted in the context of the USGCRP. The Federal Coordinating Council on Science, Engineering, and Technology (FCCSET), through its Committee on Earth and Environmental Sciences (CEES), is responsible for developing and coordinating the USGCRP, and for the activities and requirements of the USGCRP and, therefore, for the Space-based Global Change Observation System. All S-GCOS agencies shall participate with other USGCRP agencies and the CEES in the development and coordination of the Space-based Global Change Observation System Program Plan. The provision, management, and exchange of data will be a key element of the USGCRP.

The CEES will coordinate the interagency development of the Global Change Data and Information System (GCDIS), which integrates appropriate observations, regardless of platform basing mode or orientation of data (land, oceanographic, atmospheric, or space). All agencies involved with S-GCOS will participate with other USGCRP agencies in planning for the GCDIS, with a goal of maximizing the system's interoperability. Data sets intended for the GCDIS shall be responsive to the requirements of, and be accessible to, global change scientists and U.S. Government-authorized research and operational users.

c. National Aeronautics and Space Administration (NASA)

The National Aeronautics and Space Administration is the lead agency for planning Space-based Global Change Observation System activities, and is responsible for developing and operating the NASA component of the S-GCOS. This component shall be developed to provide maximum program flexibility within budget constraints. As part of the USGCRP, NASA shall:

1. Lead the development and preparation of a coordinated interagency Space-based Global Change Observation System Program Plan, to be delivered to the National Space Council (NSpC),

National Security Council (NSC), the Office of Science and Technology Policy (OSTP), and the Office of Management and Budget (OMB) by the CEES through FCCSET. This plan will guide agencies' S-GCOS activities.

2. Continue with the Mission to Planet Earth by conducting the ongoing development, operation, and scientific use of instruments and satellites designed to observe and monitor processes that govern key aspects of global environmental change.

3. As part of the Mission to Planet Earth, develop the Earth Observing System (EOS), comprised of intermediate and small sized satellites as recommended by the EOS Engineering Review Panel.

4. Plan and develop, in an incremental and evolutionary manner, the EOS Data and Information System (EOSDIS), which is the NASA part of the data and information system for S-GCOS. This data and information system shall be compatible with other parts of the USGCRP Global Change Data and Information System, and able to incorporate, as appropriate, currently available Earth observations, such as those from Landsat, and provide an active archive for S-GCOS system data sets. Prototype versions of this system, using existing Earth observations, shall be constructed to demonstrate system utility and functions.

5. Develop new instruments and space systems for global change monitoring, utilizing technologies from NASA and other S-GCOS agencies. A plan for related NASA research and development activity shall be integral to the interagency-coordinated Space-based Global Change Observation System Program Plan.

d. Department of Energy (DOE)

The Department of Energy shall participate with NASA and the other appropriate S-GCOS agencies in developing satellite systems to maintain data continuity for the understanding of the Earth's radiation budget, starting in 1995, consistent with the Space-based Global Change Observation System Program Plan.

The DOE shall participate with other S-GCOS agencies in conducting research and development for advanced technologies that can offer promise of increased performance and/or lower cost for advanced long-term global change monitoring systems. A plan for related DOE research and development activity shall be integral to the interagency-coordinated Space-based Global Change Observation System Program Plan.

e. Department of Defense (DoD)

The participation of the Department of Defense in the Space-based Global Change Observation System shall consist of related activities derived from current and planned DoD programs. DoD, in cooperation with the Director of Central Intelligence, as appropriate, will identify those technologies and programs that support the S-GCOS and shall seek to make appropriate technology and data from those programs available. DoD may also seek to identify and take advantage of S-GCOS programs and capabilities, as appropriate.

f. Department of Commerce (DOC)

The Department of Commerce, through the National Oceanic and Atmospheric Administration (NOAA), shall participate in the collection, processing, archiving, retrieval, and use of oceanic- and atmospheric-oriented data and shall, consistent with the Space-based Global Change Observation System Program Plan, provide for the permanent archiving, management, access, and distribution of oceanic and atmospheric Earth science data sets for global change research, including data sets obtained by the S-GCOS. DOC/NOAA shall work with other appropriate agencies to transition, as appropriate, systems, technology, and/or sensors developed for use in the S-GCOS to operational use. The Space-based Global Change Observation System Program Plan shall include a discussion of the criteria related to the desirability and economic feasibility of transitioning specific S-GCOS assets to operational use.

g. Department of the Interior

The Department of the Interior shall assist in the collection, processing, archiving, retrieval, and use of land-oriented data and shall, consistent with the Space-based Global Change Observation System Program Plan, provide for the permanent archiving, management, access, and distribution of land-oriented Earth science data sets for global change research, including data sets obtained by S-GCOS.

h. Department of State

The Department of State has a role in Space-based Global Change Observation with respect to international agreements, significant activities, or arrangements with foreign countries, international organizations, or commissions where the United States and one or more foreign countries are members. Prior to discussions between participating agencies and foreign entities that could reasonably be expected to lead to such agreements, activities, or arrangements, the Department of State shall be consulted and, as appropriate, shall coordinate interagency review of the proposed U.S. position to ensure consistency with U.S. foreign policy, national security, and economic interests, and satisfaction of applicable legal requirements. This shall not affect the ability of participating agencies

to explore, in accordance with established procedures, scientific, technical, and programmatic aspects of proposed international cooperation that do not involve commitments or foreign policy concerns.

Reporting Requirements

a. NASA shall lead the preparation of a coordinated and integrated interagency Space-based Global Change Observation System Program Plan that shall be forwarded by the CEES through FCCSET to the NSpC, NSC, OSTP, and OMB not later than July 1, 1992. This plan shall address the S-GCOS architecture, existing and planned S-GCOS satellite systems, technology development activities, sensor suites, launch systems, supporting agency contributions, and the data and information systems.

b. Each March, FCCSET/CEES shall prepare and forward a Space-based Global Change Observation System Program Report on the progress and accomplishments of the S-GCOS to the NSpC, NSC, OSTP, and OMB. The Space-based Global Change Observation System Program Plan will meet this requirement for 1992.